



SATURDAY, AUGUST 22, 1874.

[Entered according to Act of Congress, in the year 1874, by the RAILROAD GAZETTE, in the office of the Librarian of Congress, at Washington.]

CATECHISM OF THE LOCOMOTIVE.

By M. N. FORNEY, Mechanical Engineer.

PART XIX.

THE RESISTANCE OF TRAINS.

QUESTION 397. What is meant by the resistance of trains or cars?

Answer. It is the power required to move them on the track. Thus if a rope, fig. 219, was attached to a car at one end, and the other passed over a pulley, *a*, and a sufficiently heavy weight, *W*, was hung on the end of the rope, it would move the car. The weight *W* would then be equal to the resistance of the car.

QUESTION 398. How can the resistance of cars under different circumstances be determined?

Answer. It has been found that it takes a force of about 6 lbs. per ton (of 2,000 lbs.) to move a car slowly on a level and straight track after it is started. That is, if a car weighs 20 tons and a rope, fig. 219, is attached to it at one end and the other passed over a pulley, *a*, with a weight, *W*, suspended to it, it will require a weight equal to $20 \times 6 = 120$ lbs. to keep the car moving slowly after it is started. If two cars of the above weight were coupled together, it would require twice 120, or 240 lbs., and if three were attached to each other, three times 120, or 360 lbs., and so on. In other words, MULTIPLYING THE TOTAL WEIGHT OF THE CARS IN TONS (OF 2,000 LBS.) BY 6 WILL GIVE US THEIR RESISTANCE, OR THE FORCE REQUIRED TO KEEP THEM MOVING ON A LEVEL AND STRAIGHT TRACK AT A SLOW SPEED AFTER THEY ARE STARTED. The resistance is represented by the weight above, and the locomotive must exert a force equal to that weight to keep the train moving. As the speed increases the resistance increases, as is shown by the following table. It should be stated here, however, that our knowledge regarding this whole subject of the resistance of American cars and trains is exceedingly inaccurate and imperfect, and the data given in the books are nearly all based on experiments made in Europe, with cars of a different construction from those used here. There is reason for believing, however, that the resistance of American cars is less than European cars, and therefore we have assumed it to be 6 lbs. per ton on a level at very slow speeds, which is less than the resistance which is usually given, but the following figures should be regarded merely as approximations to the actual facts, of which we are still in ignorance:

Velocity of trains in miles per hour...	5	10	15	20	25	30	35	40	45	50	60	70
Resistance on straight line in lbs. per ton (of 2,000 lbs.).....	6.1	6.6	7.3	8.3	9.6	11.2	13.1	15.3	17.8	20.6	27.0	34.6

Now if we want to get the resistance at 30 miles an hour of a train of ten cars weighing each 20 tons, the calculation would be $10 \times 20 \times 11\frac{1}{2} = 2,250$ lbs. This will give the resistance on a level and straight track. On an ascending grade the resistance is greater than that given above, because, besides pulling the car horizontally, it is necessary to raise it vertically a distance equal to the ascent of the grade. Thus if we have a grade with a rise of 40 feet in a mile the amount of energy required to simply raise the weight of a car would be equal to its weight in pounds multiplied by the vertical height of the ascent. Thus, supposing a car which weighs 40,000 lbs. to be run one mile on a grade of forty feet ascent in that distance, then the energy expended in simply raising the car will be equal to $40,000 \times 40 = 1,600,000$ foot-pounds. Now if it was necessary to raise that weight by a direct vertical lift or pull it would require a force equal or a little greater than the load to do it. But in pulling a car or train up a grade, which is an inclined plane, the force, which is the locomotive, instead of being exerted through the vertical distance is exerted through the horizontal distance, which in this case is one mile, or 5,280 feet. Therefore if we divide the number of foot-pounds of energy required by the distance through which the power is exerted, it will give us the force exerted through one foot. That is, $\frac{1,600,000}{5,280} = 151.5$ lbs. The resistance, which is due to the ascent alone of a train on a grade or in-line can therefore be calculated by MULTIPLYING THE WEIGHT OF THE TRAIN IN POUNDS BY THE ASCENT IN ANY GIVEN DISTANCE IN FEET AND DIVIDING THE PRODUCT BY THE HORIZONTAL DISTANCE IN FEET. Thus in the above example the rate of the ascent is given in so many feet per mile; we therefore multiply by 40 and divide by 5,280, which is the number of feet in a mile. If the rate of the gradient had been given, as it sometimes is, as 1 in 132, we would simply have divided the weight of the train by the latter number. If we want to get the resistance per ton of train we substitute for its weight that of one ton in pounds; thus:

$$\frac{2000 \times 40}{5280} = 15.1 \text{ lbs.}$$

If now we have the resistance which is due to the ascent or gravity alone, we must add to this the resistance on a straight and level track in order to determine the total resistance on the grade. That of the above car on a level road at a speed of 5 miles per hour would be 6.1 lbs., so that on a grade of 40 feet to a mile at that speed its resistance would be $6.1 + 15.1 = 21.2$ lbs. per ton, and at 10 miles it would be $6.6 + 15.1 = 21.7$ lbs.,

and at 30 miles per hour on the grade the resistance would be $11.2 + 15.1 = 26.3$ lbs. per ton. To get the total resistance on a grade for any speed, we add the resistance for that speed ON A STRAIGHT AND LEVEL LINE TO THE RESISTANCE DUE TO THE ASCENT ABOVE. In the following table the resistances for various rates of speed and grades have been calculated:

Table of Train Resistances with Different Grades and Speeds.

Rise of gradient, feet per mile.....	Resistance due to ascent alone in lbs. per ton (2,000 lbs.) of train.....	Total resistance, lbs. per ton, at rate of 5 miles per hour...	10 miles per hour...	15 miles per hour...	20 miles per hour...	25 miles per hour...	30 miles per hour...	35 miles per hour...	40 miles per hour...	45 miles per hour...	50 miles per hour...	60 miles per hour...	70 miles per hour...
0.....	6.1	6.6	7.3	8.3	9.6	11.2	13.1	15.3	17.8	20.6	27.0	34.6	
5.....	1.8	7.9	8.4	9.1	10.1	11.4	13.0	14.9	17.1	19.6	22.4	29.6	
10.....	3.7	9.8	10.3	11.0	12.0	13.4	14.9	16.8	19.0	21.5	24.3	30.7	
15.....	5.6	11.7	12.2	12.9	13.9	15.2	16.8	18.7	21.0	23.4	26.2	33.6	
20.....	7.5	13.6	14.1	14.8	15.8	17.1	18.7	20.6	22.8	25.3	28.1	34.5	
25.....	9.4	15.5	16.0	16.7	17.7	19.0	20.6	22.5	24.7	27.2	31.0	37.4	
30.....	11.3	17.4	17.9	18.6	19.6	21.0	22.5	24.4	26.6	29.1	31.9	38.3	
35.....	13.2	19.3	19.8	20.5	21.5	22.8	24.4	26.3	28.5	31.0	33.8	40.2	
40.....	15.1	21.2	21.7	22.4	23.4	24.7	26.3	28.2	30.4	32.9	35.7	42.1	
45.....	17.0	23.1	23.6	24.3	25.3	26.6	28.2	30.1	32.3	34.8	37.6	44.0	
50.....	18.9	25.0	25.5	26.2	27.2	28.5	30.1	32.0	34.2	36.7	39.5	45.9	
60.....	22.7	28.8	29.3	30.0	31.0	32.3	33.9	35.8	38.0	40.5	43.3	49.7	
70.....	26.5	32.6	33.1	33.8	34.8	36.1	37.7	39.6	41.8	44.3	47.1	53.5	
80.....	30.3	36.4	36.9	37.6	38.6	39.9	40.5	42.4	44.6	47.1	49.9	56.3	
90.....	34.0	40.0	40.5	41.3	42.3	43.6	45.2	47.1	49.3	51.8	54.6	60.9	
100.....	37.8	43.9	44.4	45.1	46.1	47.4	49.0	51.0	53.1	55.6	58.4	64.7	
110.....	41.6	47.7	48.2	48.9	49.9	51.2	52.8	54.7	56.9	59.4	62.2	68.5	
120.....	45.4	51.5	52.0	52.7	53.7	55.0	56.6	58.5	60.7	63.2	66.0	72.3	
130.....	49.2	55.3	55.8	56.5	57.5	58.8	60.4	62.3	64.5	67.0	69.8	76.1	
140.....	53.0	59.1	59.6	60.3	61.3	62.6	64.2	66.1	68.3	70.8	73.6	79.9	
150.....	56.8	62.9	63.4	64.1	65.1	66.4	68.0	69.9	72.1	74.6	77.4	83.7	
160.....	60.6	66.7	67.2	67.9	68.9	70.2	71.8	73.7	75.9	78.4	81.2	87.5	
170.....	64.3	70.4	70.9	71.6	72.6	73.9	75.5	77.4	79.6	82.1	84.9	91.2	
180.....	68.1	74.2	74.7	75.4	76.4	77.7	79.3	81.2	83.4	85.9	88.7	95.0	
190.....	71.9	78.0	78.5	79.2	80.2	81.5	83.1	85.0	87.2	89.7	92.5	98.8	
200.....	75.7	81.8	82.3	83.0	84.0	85.3	86.9	88.8	91.0	93.5	96.3	102.6	
210.....	79.5	85.6	86.1	86.8	87.8	89.1	90.7	92.6	94.8	97.3	100.1	106.4	
220.....	83.3	89.4	89.9	90.6	91.6	92.9	94.5	96.4	98.6	101.1	103.9	110.2	
230.....	87.1	93.2	93.7	94.4	95.4	96.7	98.3	100.2	102.4	104.9	107.7	114.0	
240.....	90.8	96.9	97.4	98.1	99.1	100.4	102.0	103.9	106.1	108.6	111.4	117.8	
250.....	94.6	100.7	101.2	101.9	102.9	104.2	105.8	107.7	109.9	112.4	115.2	121.5	
260.....	98.4	104.5	105.0	105.7	106.7	107.9	109.5	111.5	113.7	116.2	119.0	125.3	
270.....	102.2	108.3	108.8	109.5	110.5	111.8	113.4	115.3	117.5	120.0	122.8	129.1	
280.....	106.0	112.1	112.6	113.3	114.3	115.6	117.2	119.1	121.3	123.8	126.6	132.9	
290.....	109.8	115.9	116.4	117.1	118.1	119.4	121.0	122.9	125.1	127.6	130.4	136.7	
300.....	113.6	119.7	120.2	120.9	121.9	123.2	124.8	126.7	128.9	131.4	134.2	140.5	

The top horizontal row of figures gives the rates of speed. The left-hand vertical row gives the rise of grade in feet per mile. The resistance for any given grade and speed is given where the vertical row of figures under the rate of speed and the horizontal row opposite the rise of the grade intersect each other. Thus for a grade of 30 feet per mile and a speed of 45 miles per hour we follow the vertical column under the 45 downward, and the horizontal column opposite 30 to the right, and where they intersect the resistance, 29.1 lbs. is given.

QUESTION 399. What effect do curves have on the resistance of trains?

Answer. They increase the resistance, but in what proportion or to what degree is not known accurately. European authorities say that the resistance is increased, over what it would be in a straight and level line, about 1 per cent. for every degree of the curve occupied by a train. It is probable, however, that the resistance of American cars, which nearly all have double trucks, is not so great on curves as that of European cars, which nearly all have long and rigid wheel-bases, and whose wheels therefore cannot adjust themselves so easily to the curvature of the track as they can when the American system of double trucks is used.

QUESTION 400. What is meant by a degree of a curve?

Answer. In order to measure circles, they are all supposed to be divided into 360 equal parts, which are called degrees. One degree of a curve is therefore 1-360 of a complete circle; but if the curve has a long radius, one degree of such a curved track will be longer than one degree of a curve with a short radius, but each will have the same amount of "bend" or curvature. It is this latter which increases the resistance of trains, and the greater the number of degrees of a curve occupied by a train of cars the greater will be the "bend" of the track and therefore the greater the resistance.

QUESTION 401. What other causes affect the resistance of trains?

Answer. The condition of the track and the force and direction of the wind. On a rough track the resistance is very much greater than on a smooth one, and a strong head wind makes it much more difficult to pull a train than it is in calm weather.

PART XX.

PROPORTIONS OF LOCOMOTIVES.

QUESTION 402. In proportioning a locomotive to any given kind of work, what are the first facts which should be known?

Answer. We should first know the weight of the train which the locomotive must draw; second, the speed at which it must run; and third, the steepest grades and the shortest curves of the road on which it must work. From these the resistance of the train which the locomotive must overcome can be at least approximately determined.

QUESTION 403. When the greatest resistance of the train is known, what is the next thing to be determined?

Answer. As was stated in answer to Question 63, if the wheels revolve and their adhesion is greater than the resist-

ance opposed to the movement of the locomotive, the latter will overcome the resistance; but if the latter is greater than the friction, the wheels will slip. It therefore follows that the adhesion must be somewhat greater than the resistance. As the adhesion is equal to about one-fifth* of the adhesive weight or pressure of the driving wheels on the rails,

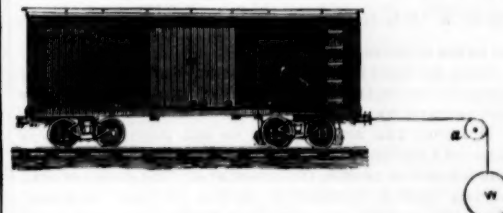


Fig. 219.

weight which can be carried on a single wheel depends upon the material of which the rails are made, and to some extent on their form and size, or as the latter is usually expressed, on their weight per yard.

QUESTION 405. When the adhesive weight and the number of driving-wheels are known, how is the size of the latter and of the cylinders determined?

Answer. The size of the wheels will to a certain extent depend upon the speed, because the larger the wheels, the further will the locomotive move in one revolution; but no exact rule can be given for their size. At present there is still a great diversity of opinion among engineers regarding the best sizes of wheels and cylinders for any given service. Probably the safest plan will be to consult the best practice, and in the absence of any better reasons be guided by that. In this country the most common size of locomotives used is that which we have selected for our illustrations, which have what are called five-foot wheels, and cylinders of 16 inches diameter and 24 inches stroke. More engines of these dimensions are used than of any other. For freight service the wheels are sometimes made of smaller and for passenger trains of larger diameter; but locomotives with driving wheels and cylinders of the dimensions given are used for both passenger and freight service. It should be stated here that what are called five-foot wheels are usually about $1\frac{1}{4}$ in. larger than five feet. This arose from the fact that the tires which are now used are made thicker than they were on the first engines, and the practice thus established has been continued. We will therefore take

*See answer to Question 301.

the diameter of what is called a five-foot wheel at what it really is, 61½ in. Such locomotives also have about 40,000 lbs. of adhesive weight. Now the circumference of such wheels is 193.2 in., and therefore in one revolution of the wheels, if they do not slip, the locomotive will move that distance on the rails. At the same time each piston will sweep through the cylinder twice, and therefore in one revolution 4 times one cylinder full of steam is used. Now a cylinder of 16 in. diameter and 24 in. stroke contains or will hold 4,825½ cubic inches, so that in one revolution of the wheels $4,825\frac{1}{2} \times 4 = 19,302$ cubic inches of steam are used. As has been stated, in one revolution of the wheels, if they do not slip, the locomotive will move 193.2 in. If now we divide 19,302 by 193.2 it will give us the amount of steam used to move the locomotive and train one inch. Now $19,302 \div 193.2 = 99.9$, which for the sake of even figures we will call 100, 198.2

We thus see that a locomotive with 40,000 pounds or 20 tons (of 2,000 lbs.) of adhesive weight requires 100 cubic inches of cylinder capacity† to move it one inch. Now if a locomotive had only half as much weight on the driving-wheels, it could pull only half as much load, and would therefore use only half as much steam, and consequently need only half the cylinder capacity of the other locomotive. If there was three-quarters or a third the adhesive weight, the cylinder capacity should also be three-quarters or a third. We thus see that the cylinder capacity should be proportioned to the total adhesive weight. Now as 100 cubic inches of cylinder capacity are needed to move an engine with 20 tons adhesive weight one inch, if we divide 100 by 20 we will get the cylinder capacity needed for each ton. That is $\frac{100}{20} = 5$ CUBIC IN. CYLINDER CAPACITY PER TON (OF 2,000 LBS.) OF ADHESIVE WEIGHT NEEDED TO MOVE ANY LOCOMOTIVE ONE INCH. This quantity we have named the modulus of propulsion.

Supposing now that it is required to calculate the cylinder capacity for a locomotive with 15 tons adhesive weight, and wheels 4½ feet or 54 in. in diameter. We will first multiply 15 by the modulus of propulsion, $15 \times 5 = 75$ = the number of cubic inches of cylinder capacity required to move such a locomotive one inch. Multiplying the length of the circumference of the wheels, which in this case is 169.6 in. by 75, will give us the total cylinder capacity for one revolution. That is $169.6 \times 75 = 12,720$ cubic inches of cylinder capacity, or the space which should be swept through by the two pistons. Dividing this by 4 will give us the cubical contents in inches of one of the cylinders. Thus, $\frac{12,720}{4} = 3,180$ cubic inches = the capacity of one cylinder. Now as the capacity of a cylinder is calculated by multiplying its area by its length, if we have the one we can easily determine the other. Thus, supposing it was intended to make the stroke of the pistons 22 in., dividing 3,180 by 22 will give us the area of the piston. Thus $\frac{3,180}{22} = 144.5$ square inches. Now by the well-known rule in mensuration, if we divide the area of a circle by 0.7854, the square root of the quotient will be the diameter OF THE CIRCLE. Thus $\frac{144.5}{0.7854} = 183.9$. The square root of 183.9 is 13½ nearly, which should be the diameter of the cylinder. Instead of calculating the diameter of the circle, a more convenient way is to refer the area to a table of areas, and from it find the diameter. Of course if we have the diameter of the piston and want to get the stroke, we divide the CUBICAL CONTENTS OF THE CYLINDER BY THE AREA OF THE PISTON. Thus in the present illustration, if it was intended to have the piston 13½ in. diameter, we would have divided 3,180 by the area of a piston 13½ in. diameter, which is 143.1, so that we would have $\frac{3,180}{143.1} = 22$, nearly, = inches of stroke of piston.

From the above considerations we can deduce the following RULE FOR CALCULATING THE CAPACITY OF THE CYLINDERS WHEN THE ADHESIVE WEIGHT IS KNOWN:

MULTIPLY THE TOTAL WEIGHT ON THE DRIVING-WHEELS IN TONS (OF 2,000 LBS.) BY 5, AND THEN BY THE CIRCUMFERENCE OF THE WHEELS IN INCHES, AND DIVIDE BY 4. THE QUOTIENT WILL BE THE CUBICAL CONTENTS IN INCHES OF EACH CYLINDER. From this, if either the diameter or stroke is given, the other can easily be found, as has been explained.

It should be remarked here that it is unimportant, so far as the power of the locomotive is concerned, whether the cylinders have a large diameter and a short stroke or a small diameter and a long stroke, provided the cubical contents are the same. Thus cylinders 17½ in. in diameter and with 20 in. stroke would have almost exactly the same capacity and the same power would be exerted with them as with cylinders 16 × 24 in.; the only difference would be that with the one with the cylinder of the largest diameter the pressure on the piston and consequently on the crank-pin journal and the strain on the parts would be greater than with the smaller cylinder. The difference in pressure would, however, be exactly compensated by the loss or gain in the leverage exerted through the driving-wheels on the rails.

QUESTION 406. What circumstances should determine the size of locomotive boilers?

Answer. They should be proportioned to the amount of adhesive weight, and to the speed at which the locomotive is intended to work. Thus, a locomotive with a great deal of weight on the driving-wheels could pull a heavier load and would, by the above rule for proportioning the cylinders, have a greater cylinder capacity than one with little adhesive weight, and would therefore consume more steam and therefore should have a larger boiler. It is also obvious that if a locomotive like that shown in figs. 40 and 41 should have a boiler just large enough to furnish steam when running at the

rate of 20 miles an hour, it would be too small if the locomotive ran 40 miles an hour, the train resistance being the same in both cases. Driving-wheels 5 feet in diameter would at 20 miles per hour make 112.1 revolutions per minute, and would therefore consume 448.4 cylinders-full of steam. At 40 miles per hour double the number of revolutions would be made, and consequently twice the quantity of steam would be used, and therefore the boiler should have twice the steam-producing capacity. If, therefore, we know the size of a boiler required for a given amount of adhesive weight and a given speed, we can easily calculate the boiler capacity for any other weight and speed.

QUESTION 407. How can we determine the boiler capacity needed for an engine with a given amount of adhesive weight and for a given speed?

Answer. This must be determined empirically, that is by experience.

QUESTION 408. On what does the steam-generating capacity of a boiler depend?

Answer. First, upon the size of its grate and fire-box, because more fuel can be burned in a large fire-place than in a small one; second, on the amount of heating surface to which the products of combustion are exposed, and third, in the draft produced by the blast or exhaust steam. Of course the amount of steam generated is also dependent upon a great variety of other circumstances, such as the nature of the combustion, the firing, the arrangement of the fire-box, grates, etc., and the condition of the heating surfaces; but these have nothing to do with the proportions or size of the boiler.

QUESTION 409. What are the proportions of boilers used in locomotives like that which has been illustrated in these articles and represented in figs. 40 and 41?

Answer. The area of the grate is about 2,100 square inches, and the total heating surface about 800 square feet, and the water capacity about 5,000 lbs., and the total weight of the boiler, including all the boiler attachments and appliances for promoting combustion, about 30,000 lbs.

QUESTION 410. At what speed are such engines usually run?

Answer. The speed varies so much under different circumstances that it is impossible to give even approximately the average speed of such engines.

QUESTION 411. How then can we determine the proper proportions of a boiler for a locomotive intended for any given service?

Answer. As stated before, this can only be done empirically. The safest method is to select a locomotive which is doing the best service, and learn the average speed at which it runs, the size of its grate and the amount of its heating surface, and its adhesive weight. Now MULTIPLY THE ABOVE SPEED IN MILES PER HOUR BY THE ADHESIVE WEIGHT OF THE LOCOMOTIVE IN TONS (OF 2,000 LBS.) AND DIVIDE THE PRODUCT INTO THE AREA OF THE GRATE IN SQUARE INCHES. THEN MULTIPLY THE ADHESIVE WEIGHT OF THE LOCOMOTIVE FOR WHICH THE BOILER IS TO BE PROVIDED BY ITS SPEED, AND BY THE QUOTIENT OBTAINED ABOVE: THE PRODUCT WILL BE THE AREA OF THE GRATE IN SQUARE INCHES FOR THE NEW ENGINE. To illustrate this, suppose an engine of the dimensions given to run at an average speed of 20 miles per hour. Now, multiplying that speed by the number of tons of adhesive weight and dividing the product into the area of the grate, we have $\frac{2100}{20 \times 20} = 5.25$. We now want to determine the size of a grate for the boiler of a locomotive with 30 tons of adhesive weight and to run at a speed of 15 miles per hour. We therefore multiply 15 by 30 and the product by the above quotient, or $15 \times 30 \times 5.25 = 2,362.5$ = square inches of grate surface for the boiler. The required heating surface can be obtained in a similar way, by substituting it instead of the grate surface in the calculations.

QUESTION 412. How is the size of locomotive boilers usually limited?

Answer. By the weight of the locomotive and to some extent by the distance between the rails. It will be found often that it is impossible to make the boiler the size indicated by a calculation similar to the above without at the same time making the weight of the locomotive and the adhesive weight greater than was assumed. The result of such a calculation indicates, therefore, that too large a proportion of the weight of the locomotive was on the driving-wheels for the speed at which it was intended to work, and that either they should bear less weight or the speed be reduced.

QUESTION 413. In what respects is the operation of locomotive boilers different from that of nearly all other steam boilers?

Answer. The amount of steam generated in proportion to the amount of heating surface is much greater in locomotive boilers than in any other kind. To produce combustion which will be sufficiently active to generate the requisite quantity of steam, the fire must be stimulated by the blast created by the exhaust steam to a degree unknown in other kinds of boilers. So rapid is the movement of the products of combustion that a smaller proportion of the heat is imparted to the water contained in the boiler, and consequently a less amount of water is evaporated in proportion to any given amount of fuel than in boilers in which combustion is less violent. The combustion is also less perfect, because the strong draft does not allow time for a perfect combination of the gases which produce combustion.

The supply of steam which a locomotive boiler must furnish is also much more irregular than the demands made upon any other kind of boiler. At one time the fire must be urged to the greatest possible intensity in order to furnish steam enough to pull a train up a steep grade. When the top is reached the demand ceases, and the boiler can be cooled. The load which a locomotive can pull over a given line of road is limited entirely by the utmost capacity of the boiler to supply steam at these critical periods.

QUESTION 414. What relation is there between this irregular action and the size of the boiler?

Answer. The smaller the boiler, or rather the larger the

amount of steam which must be generated in a given time in proportion to the heating surface, the more must the fire be urged; and therefore the smaller the boiler in proportion to the work it must do, the less will be its economy. In order to produce a rapid combustion in a small boiler, it is necessary to contract the exhaust nozzles in order to create a draft strong enough. In doing this the back pressure on the pistons is very much increased, and when the blast becomes very violent a great deal of solid coal is carried through the tubes and escapes at the smoke-stack unconsumed. At the same time large quantities of unconsumed gases escape, because there is not time for combustion to take place in the fire-box. The fact that with a violent draft the flame and smoke are in contact with the heating surface for a sensibly shorter period of time also has its influence; as less heat will be imparted to the water if the products of combustion are only 1-100 of a second instead of 2-100 in passing through the tubes.

There is another consideration which should be taken into account in this connection, which is, that if a boiler is so small that it is worked nearly up to its maximum capacity at all times, it will be impossible to accumulate any reserve power in it in the form of water heated to a high temperature to be used as occasion may require. With a boiler having a great amount of heating surface and capacity for carrying a large quantity of water, the latter can be heated at times when the engine is not working hard, and the heat thus stored up in the water can then be used when it is most needed. Thus we will suppose that to pull a train of cars on a level 250 lbs. of steam are consumed per mile. On a grade of 30 feet per mile the resistance will be three times what it is on a level, and therefore three times the quantity of steam will be consumed, so that the boiler must then evaporate 750 lbs. of water per mile. Now to convert 250 lbs. of water heated up to a temperature due to 130 lbs. of effective pressure, or 355.6 degrees, into steam of that pressure will require 216,575 units of heat. If at the same time that this steam is being consumed, we pump into the boiler 250 lbs. of water of a temperature of 60 degrees, 73,800 more units of heat will be needed to raise it to the temperature due to 130 lbs. effective pressure, so that on the level part of the road it would be necessary to transmit to the water in the boiler $216,575 + 73,800 = 290,375$ units of heat in a mile. If there is no room in the boiler for storing a surplus quantity of hot water, it will be necessary on a grade as fast as the steam is consumed to feed an equivalent amount of cold water to take the place of that which was converted into steam, so that on a 30 feet grade it would be necessary to convert at the rate of 750 lbs. of hot water into steam in a mile, which would require 649,725 units of heat, and at the same time heat an equal amount of cold water to a temperature due to the pressure of the steam, which would require 221,700 more units. So that it will be necessary to transmit at the rate of 871,425 units of heat to the water per mile. Now if the boiler was so large that more water could be pumped into it and heated than was used on the level portion of the road, and could there be stored up for future use, the pumps might be either partly or entirely shut off when the engine was working the hardest on the grade. In this way, instead of being obliged to convert hot water into steam, and at the same time heat an equal amount of cold feed-water, there would be a surplus of hot water stored up already heated. It would therefore only be necessary to convert this hot water into steam, which will require a transmission of heat to the water at the rate of 649,725 units of heat instead of 871,425. It must be remembered that on nearly all roads there are certain difficult places which practically limit the capacity of the locomotives on that line. If therefore the capacity of the engines can be increased at those points, their capacity over the whole line is increased. It will be seen by the above illustration that by having a large boiler it is necessary for it to do very much less work at the critical period, when, as every locomotive runner knows, it is often of the utmost importance to make use of every possible available means in order to pull the trains. It is true that on a very long grade the supply of surplus hot water would soon be exhausted, but even in such cases there is usually one place, owing to a curve or other cause, which is more difficult to surmount than any other, in which case it will be necessary to use more steam for a short time than the locomotive can generate if the boiler is fed continuously. For such cases a surplus of water can be used. But even if the resistance is equal over the whole length of the incline, still the large boiler will have the advantage, because it can at all times generate more steam than a smaller one. It may therefore, we think, safely be assumed that locomotive boilers should always be made as large as the weight of the locomotive will permit.

QUESTION 415. What effect does the size of the driving wheels have upon the combustion and evaporation of locomotive boilers?

Answer. As small wheels make more revolutions in running a given distance than large ones, there will be more strokes of the piston with the former than with the latter, if the locomotive in both cases runs at the same speed. As smaller cylinders are usually employed with small wheels, the blast up the chimney is then composed of a larger number of discharges of steam, but each one of less quantity than when larger wheels and cylinders are used. In the one case the "puffs" of steam are many and small, and in the latter few and large. If the cylinders are proportioned by the rule which has been given for that purpose, the amount of steam discharged in running any given distance will be the same with engines having large and those with small wheels, the only difference being that it will be subdivided into a greater number of discharges in the one case than in the other. Now it is found that the draft of engines is much more effective on the fire, when the blast is thus subdivided, that is when small wheels and cylinders are used, than it is with large ones, and therefore more steam is generated with the former than with the latter.

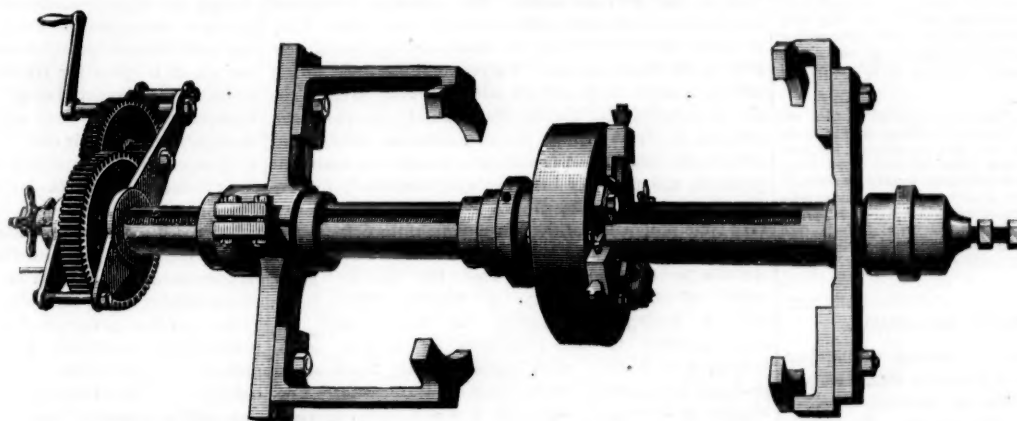
QUESTION 416. What relation is there between the size of the wheels and that of the boiler?

† The cylinder capacity is the space swept through by the two pistons. In the above illustration what is meant is, that the average space in the cylinder swept through by the piston is 100 cubic inches for each inch that the locomotive advances.

Answer. As has been explained, the size of the boiler is limited by the weight of the locomotive. The boiler and its attachments of an American locomotive, when the former is filled with water, weigh about half as much as the whole locomotive; therefore, unless we increase the weight of the latter or decrease the weight of the machinery, we cannot increase the size of the boiler. Now, large wheels are heavier than small ones; they require larger cylinders, stronger connections, heavier frames, and in fact nearly all the parts of the machinery used with large wheels must be heavier than are required when small wheels are used. Therefore, by decreasing the size of the wheels all the other parts of the engines proper can be made lighter than is possible if large wheels are used, and thus the size and weight of the boiler can be increased without increasing the whole weight of the locomotive. There is, of course, a practical limit below which the size of the wheels cannot be reduced, because the speed of the piston would become so great as to be injurious to the machinery. By reducing the stroke, however, with the diameter of the wheels, the evil referred to may be obviated to a great extent. A cylinder with a large diameter and comparatively small stroke has the advantage that there is less surface exposed to radiation of heat than there is in a cylinder in which these proportions are reversed.

Patent Portable Cylinder Boring Machine.

This machine is so arranged that it can be attached to an engine standing on the track, and is driven or worked either by hand or power. The boring head slides upon a bar 4 inches in diameter, one end of which is placed in a bushing fastened in a stuffing box, and the other end runs in a bearing bolted to the cylinder flange. The boring head has three tool-holders, which will receive either boring, facing or turning cutters, and each of all of the cutters have an automatic and a hand feed; and as a bearing for the boring bar for each end of the cylinder is furnished, if required, it will be readily seen that with this machine a cylinder can be bored and the flanges turned and faced on their edges. These machines will bore a



Patent Portable Machine for Boring Locomotive Cylinders. By the New York Steam Engine Company.

cylinder as small as 15 inches and as large as 20 inches in diameter, with an extreme traverse of head of 32 inches. They are also made of any size and length required for stationary and marine cylinders. The New York Steam Engine Company, No. 98 Chambers street, New York, are the manufacturers.

ANNUAL REPORTS.

Toledo, Wabash & Western.

This company operates a main line from Toledo, O., southwest to Decatur, Ill., and thence west to Quincy, a distance of 473.6 miles, 21.5 miles of which, from Camp Point to Quincy, it leases the use of from the Chicago, Burlington and Quincy Company; a branch from Clayton, Ill., to Keokuk, Ia., 41.5 miles, of which 7 miles (from Elvaston to Keokuk) is leased; a branch from Bluffs, Ill., to Naples, 3.8 miles; and a branch from Decatur to East St. Louis 103.4 miles; total of 627.3 miles, of which 593.8 miles are owned and 23.5 leased. The 7 miles leased from Elvaston to Keokuk was included in the lines owned in last year's report.

The company also operates under leases the following lines: Lafayette, Ind., to Bloomington, Ill. 116.7 miles; Decatur, Ill., to Pekin, Ill. 67.2 miles; Naples, Ill., to Hannibal, Mo. 46.0 miles; Pittsburg branch of last line 6.0 miles.

Total	233.9
The line from Hannibal to Moberley which was operated last year was worked only half of 1873, having been transferred to the Missouri, Kansas & Texas late in June. None of these lines, however, are included in the present report.	
This property is represented in the capital account as follows:	
General stock	\$15,000,000
Preferred "	1,000,000
Total stock (\$16,000,000)	\$16,000,000
First-mortgage bonds	9,400,000
Second "	5,000,000
Equipment bonds	600,000
Consolidated mortgage bonds	2,610,000
Second consolidated mortgage bonds	2,180,000
Total funded debt (\$33,090 per mile)	\$33,090,000
Total capital account (\$59,770 per mile)	\$59,770,000

The changes in the capital account since the last report are the retirement of \$90,000 consolidated bonds and the issue of \$2,180,000 second consolidated bonds making an increase of \$2,090,000 in the funded debt.

The earnings of the road worked for the year ending December 31 were as follows:	
Freight	1873. \$4,335,226 40
Passenger	1,050,198 21
Mails	127,419 99
Express	94,382 40
Other sources	131,580 76
	1872. \$4,311,970 28
	1,132,764 60
	105,300 73
	94,664 64
	3,3768 40

Total earnings	\$5,788,907 76	\$5,008,977 65
Operating expenses	4,407,378 74	4,365,143 62
Net earnings	\$1,381,529 02	\$1,643,834 03
Gross earnings per mile	\$9.148	\$9.567
Expenses per mile	7.026	6.983
Net earnings per mile	2.122	2.585
Interest charges	2,171	2,307
Surplus or deficit	def. 49	sur. 548

The decrease in gross earnings was 4 1/2 per cent.; the increase in expenses 1 per cent., and the decrease in net earnings, 19 per cent.

A condensed statement of the financial results of the year is as follows:

Net income	\$1,331,429 02
Interest on bonded debt	\$1,299,935 00
Rent of track Quincy to Camp Pt.	40,000 00
Rent of track Elvaston to Keokuk	10,000 00
Rent Wabash Equipment Company's cars	100,000 00
Interest on preferred stock	70,000 00
	1,519,935 00
Deficit	\$188,505 98

The work done during the year was as follows:

Passengers carried	1873. 29,799	1872. 29,799
Passenger mileage	29,426,175	29,426,175
Tons of freight carried	1,442,963	1,349,052
Tonnage mileage	806,755,363	288,706,810

The increase in tonnage mileage was 5 1/2 per cent. The average charge per ton per mile in 1873 was 1.406 cents against 1.487 cents in 1872, a decrease of 0.081 cent or 5 1/2 per cent. If the rates of 1872 had been kept up, the freight receipts would have been increased by \$248,488. The increase in the movement of cars was very large.

Besides the working expenses, \$247,571.77 was expended for new equipment and \$1,095,219.01 for construction during the year. There were constructed 21.56 miles new side track at a cost of \$200,063.64, and 6,242 tons of steel rails were laid at a cost of \$697,242.68, the amount charged therefor to construction being less than actual cost by the amount required to re-roll an equal quantity of iron. Other new construction included two docks at Toledo; a pile bridge half a mile long to the new elevator at Toledo; new elevators at Peru and Williamsport, and several new water stations.

The new equipment included 6 locomotives, 1 postal car, 100 stock, 100 coal and 12 caboose cars. No statement of equipment in use is given, except that 198 locomotives were in use during the year and ran 5,567,626 miles.

Instead of a large increase of freight business during the

The increase in gross earnings was \$16,779.78, or 2.5 per cent.; in expenses, \$12,347.30, or 2.3 per cent.; and in net earnings, \$4,432.48, or 3.4 per cent. The sum of \$132,712.56 was paid on interest account, and \$44,454 as dividends on preferred stock. The work done was as follows:

	1873-74.	1872-73.
Train mileage	523,362	523,362
Passengers carried	174,925 1/2	171,611 1/2
Passenger mileage	10,495,530	10,200,690
Tons of freight carried	90,909 1/2	92,188
Tonnage mileage	5,954,940	5,631,160

The increase in passenger mileage is 1.99 per cent., and in tonnage mileage, 3.38 per cent.

The equipment has been increased by four locomotives, one passenger, one baggage and 64 freight cars. It now consists of 24 locomotives, 20 passenger, 2 drawing-room and 11 baggage cars and 585 freight cars.

Atlantic & Gulf.

This company owns and operates the following lines:

Main Line, Savannah, Ga., to Bainbridge, including Savannah River Extension (2 miles)	239
Albany Division, Thomasville, Ga., to Albany	69
Florida Division, Dupont, Ga., to Live Oak, Fla.	48
Total	346

It is intended to extend the main line west to the Mobile & Montgomery at Pollard, Ala., and the line has been surveyed and located. There are 15.82 miles of sidings in use. The property is represented by the following securities:

Capital stock	\$3,693,200
Guaranteed stock, 7 per cent.	786,477
To all stock (\$12 947 per mile)	\$4,479,677
Funded debt (\$8,506 per mile)	2,974,200
Coupon notes and free bonds (\$1,597 per mile)	852,500
Total (\$23,140 per mile)	\$8,006,377

The operations for the year ending December 31, 1873, as compared with the previous year, were as follows:

Earnings:	1873.	1872.
Passenger	\$199,577 35	\$201,707 10
Freight	740,460 81	729,512 44
Mails	33,438 70	21,720 00
Incidentals	32,461 20	31,026 83
Total	\$1,006,947 12	\$983,966 06
Expenses:		
Administrative	13,259 79	16,067 68
Roadway	227,287 93	174,993 27

Locomotive	180,014 37	172,544 26
Car	95,668 82	95,086 32
Transportation	177,133 22	186,532 48
Forwarding	7,255 73	7,941 46
Operating expenses	\$700,819 66	\$653,185 47
Extraordinary expenses	37,242 31	25,821 69
Total expenses	\$738,061 87	\$679,007 16
Net earnings	\$268,885 25	\$304,958 90
Gross earnings per mile	\$2,907	\$2,844
Net earnings per mile	774	881
Percentage of operating expenses	69.67	66.38

The year shows an increase of 2.23 per cent. in gross earnings, an increase of 7.29 per cent. in operating, and 44.23 per cent. in extraordinary expenses and a decrease of 12.16 per cent. in net earnings. The increase in expenses was mainly due to the quantity of new iron used in repairs. The extraordinary expenses were for equipment and for the survey of the Pollard Extension. The increase in freight earnings was from local freight, the through business having decreased, owing mainly to the withdrawal of the Green Line business to Savannah from the road. Local business gave 69 per cent. of the passenger and 74 per cent. of the freight receipts.

The work done was as follows:

	1873.	1872.
Passengers carried	97,227	98,234
Cotton carried, bales	128,402	124,041
Lumber carried, feet	43,286,180	46,443,722
Engine mileage	683,918	678,350
Passenger-car mileage	1,620,562	1,600,410
Service-car mileage	6,127,557	5,627,473
	407,355	545,781

In 1873, 456,415 miles was made by cars of other roads, and 27.5 per cent. of the freight-car mileage was of empty cars.

The equipment at the close of the year consisted of 26 engines, 27 passenger train cars, 331 freight train cars and 30 road and service cars. Two baggage and mail and nine platform cars had been added during the year.

The road department used in repairs 700 tons of new rails, 96,957 ties and 1,678,676 feet of lumber.

The company's efforts to secure State aid for the extension to Pollard were unsuccessful. An attempt was made to negotiate bonds in Europe for that purpose, but failed on account of the panic of last September. The construction of the extension has therefore been necessarily postponed.

Cost of Cars in Europe.

Some contracts were let recently at Strasbourg for freight cars for railroads in Alsace and Lorraine at prices given below. These four-wheeled European cars are not small vehicles like English "wagons," but calculated to carry 22,000 lbs. each, and so fully equal in capacity to our eight-wheeled cars: 100 four-wheeled cars for carrying rails at \$335 (reduced to American currency) without brakes and \$440 with brakes; 50 four-wheeled cars for carrying timber, at \$385; 50 two-story stock cars at \$555 without brakes and \$700 with; 150 coke cars at \$430 without brakes and \$530 with; 200 merchandise cars without brakes at \$370; 540 merchandise cars with brakes at \$470.



Published Every Saturday.

CONDUCTED BY

S. WRIGHT DUNNING AND M. N. FORNEY.

CONTENTS

ILLUSTRATIONS:	Page	EDITORIALS:	Page
Patent Portable Cylinder Boring Machine.....	323	Ticket Commissions in New York.....	324
CONTRIBUTIONS:		Retrospect.....	324
A Chapter of Complaints on Railroad Management.....	329	The Reports of Earnings.....	325
Some Notes by the Way.....	330	Record of New Railroad Construction.....	326
Finding Point of Reversion or Changing a Reversed Curve.....	330	NEW PUBLICATIONS.....	326
Railroad Conventions and Reform.....	330	GENERAL RAILROAD NEWS:	
Locomotive Reports and Performance.....	326	Railroad Earnings in July.....	325
The Rail Committee's Report.....	326	Elections and Appointments.....	326
EDITORIALS:		Personal.....	326
British and American Railroads.....	324	Traffic and Earnings.....	327
		The Scrap Heap.....	327
		Old and New Roads.....	327
		Annual Reports.....	328
		MISCELLANEOUS:	
		Catechism of the Locomotive.....	321

Editorial Announcements.

Addresses.—Business letters should be addressed and drafts made payable to THE RAILROAD GAZETTE. Communications for the attention of the Editors should be addressed EDITOR RAILROAD GAZETTE.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

BRITISH AND AMERICAN RAILROADS.

The railroads of Great Britain, according to the just published returns of the Board of Trade for 1873, have just doubled their receipts since 1860, the working expenses meanwhile having increased by 135 per cent. The capital invested in them has been much increased meanwhile, the mileage in a smaller proportion, the percentage of increase for the thirteen years being:

Mileage worked.....	54.3
Capital invested.....	69.6
Gross earnings.....	100.4
Working expenses.....	135.1
Net earnings.....	85.5

The proportion of net earnings to paid up capital was 4.59 in 1873 against 4.19 in 1860, so that with the doubling of total receipts the rate of profit has increased but 9½ per cent.

The items per mile are:

	1860.	1873.
Capital.....	\$162,309	\$188,030
Passenger receipts.....	6,092	7,217
Freight receipts.....	6,947	9,631
Miscellaneous receipts.....	None reported.	625
Total receipts.....	12,941	17,473
Working expenses.....	6,160	9,305
Net receipts.....	6,791	8,168

Here we have an increase of about 11 per cent. in the average cost per mile, of 35 per cent. in the average receipts per mile, of 51 per cent. in average expenses, and of 20 per cent. in average net receipts per mile.

Let us compare the statistics for 1873 with those of the United States as given in the last edition of Poor's Manual: We have added 10 per cent. to the gold values given for the British roads above in order to have the currencies the same for both:

	Great Britain.	United States.
Capital invested.....	\$196,833	\$67,134
Passenger receipts.....	7,938	2,074
Freight receipts.....	10,694	5,674
Miscellaneous receipts.....	687	Not reported.
Total receipts.....	19,220	7,948
Working expenses.....	10,235	5,174
Net earnings.....	8,984	2,775
Proportion of net earnings to capital.....	4.59 per ct.	4.85

Here we see an immense difference between the two systems so far as cost and earnings are concerned, but a very little difference in the average income on the investment, the rate being 26 cents on the hundred dollars greater in this country, which is 5½ per cent. more than the English rate of 4.59 per cent. Perhaps it is not quite fair to compare the capitals as we have done by reducing the English figures to American currency, because of the fact that a portion of the capital accounts of American roads—perhaps an eighth or more of the whole—is represented by gold bonds; but as all the other

items are given in currency, this portion of the debt should properly increase the amount of capital per mile and consequently the percentage of income on the investment. If the gold debt is equal to one-eighth of the whole capital (which is a very loose estimate, we must confess), then the currency value of the capital invested is \$57,850, and the net earnings were 4.80 per cent.—a very trifle less than given above.

The figures in this table show that British railroads have to earn per mile on an average interest on nearly three and a half times as much capital as is invested in American railroads; that they have, on the other hand, nearly two and a half times as great receipts, working expenses less than twice as great, and net earnings three and one-thirtieth as great.

Next to the immense difference in the cost of the roads is the proportion of working expenses, which in Great Britain is only 53.3 per cent. against 65.1 per cent. in this country, the English rate being abnormally high for that country by reason of the unexampled high cost of coal and iron, and in some degree of labor, in 1873. On the other hand, the British railroads had larger earnings per mile than ever before; the American roads less than the previous year.

Our railroads are subject to an influence which scarcely affects British roads at all in these days, namely, the multiplication of rival roads several times as fast as the growth of traffic. Railroads are still built in England, but it has been many years since the increase in mileage has been anything like as rapid as the increase in traffic in the country.

Another striking difference shown by the comparison above is in the productiveness of the different sources of traffic. In Great Britain the receipts from freight per mile are not twice as great as in this country (80 per cent. greater), but the passenger receipts are nearly four times as great (283 per cent. more). The passenger receipts of English roads are equal to the total earnings of ours. They are more than two-fifths of the total earnings there; here little more than a quarter. There are three great causes of this, it seems to us, and all natural causes. Great Britain is densely, the United States thinly, peopled; the products of Great Britain are manufactures chiefly, and much more valuable per pound than the average American products, and probably less weighty per inhabitant; finally, there is no room in England for long hauls, while here a very large proportion of the productions of the country has to be carried a thousand miles and more before they reach consumers or the sea. This last is the great cause of the supremacy of freight traffic here, and a lasting one—lasting at least until (if ever,) contrary to the tendencies of modern civilization, each district shall consume pretty much all it produces and produce pretty much all it consumes. The bigness of a country, especially if it is a large exporter, has a great effect on the average distance that articles of traffic must be carried: a much less effect on the average journeys of passengers; for the producer may and probably will live and die pretty near his home, while his produce may go half-way round the world to find a consumer. This necessarily large average amount of transportation per unit of produce is indeed the chief obstacle to the occupation of great interior districts on any continent. If it cannot be removed or reduced by cheap transportation, the only alternative is the establishment of a self-sufficient community, like that of Japan, for instance, buying from and selling to distant peoples very little. The Mormons in Utah before the completion of the Pacific Railroad, and to a greater degree before the establishment of frequented overland routes to California and Oregon, were an example of such a community, which however does not grow naturally in modern times, and must grow slowly at best.

Ticket Commissions in New York.

The New York ticket-sellers, whose commissions were suddenly cut off by the action of the trunk lines recently, are making a strenuous effort to re-establish their business. The association which they have formed proposes that they bind themselves not to accept special terms from any company for diverting passengers to its line, and they say that they will soon ask the railroad companies to pay them commissions as formerly. They have also had statements published affirming the great convenience of their agencies to the public, and assign that as a reason why the companies should pay them for maintaining their offices.

Now it is doubtless true that it is a convenience to the public to be able to purchase tickets at numerous places; but there certainly must be a limit to the number which the carriers are in duty bound to maintain (and they have to maintain all of them). Shall there be one on every block in Broadway, and if so will not the east-side and west-side people have reason to complain? And after all, if the people who find it convenient to buy tickets at hotels have a special service rendered to them which costs the carrier more than the service rendered to the traveler who buys a ticket at the company's offices, who should pay for it, the company or the traveler? The traveler, certainly. If the company pays for it, usually the

effect is simply the assessment of that special expense on the whole body of passengers, including those who have the benefit of no special service. The lady who wishes to have her tickets brought to her room at her hotel, her routes explained to her, her carriage called and her trunks checked, calls for an expenditure of labor and time sensibly greater than is given to him or her who buys a ticket at the station or company's office and attends to all these affairs personally. It may be a much needed service, but she ought to pay for it none the less. And there is little danger that the refusal of the companies to pay for it will make it impossible to obtain this service. If a guest wants a ticket or other service connected with his journey, and leaves his order at the hotel office, there is nothing to hinder the sending of a servant to the railroad office and the performance of the other service, just as heretofore; and the service will not take much time in each single case, usually, for the reason that there will be a number of persons to be served at once. It is true, probably, that the hotels would charge something for the trouble; but then at least the charge will come upon the person served and not upon the railroad company or the great body of railroad travelers not served in this way. Doubtless the hotels where tickets are sold make no provision now for doing such work; but how is it with the much greater number of places where tickets are not kept on commission? They have done the work, to be sure, in consideration of a share of the ticket seller's commission, without any charge to the guest; but their practice shows very well how the work may be done.

If the agents who want commissions should offer to sell tickets for a commission not exceeding the average expense to the company of selling its own tickets, they would have a plausible case. But they do not, and in the nature of things cannot. It is not possible that the ticket business of New York city should be carried on at fifty offices so cheaply as when concentrated in fifteen. But the case would be only plausible then. The commission business has been first and chiefly obnoxious because of the facilities which it gives for irregularities, illegitimate competition, and the breaking of agreements between companies. Railroad companies have difficulty enough in enforcing obedience among their own agents, and they are powerless to compel the observance of rules among those who sell their tickets for a specified commission. Constant broils and misunderstandings and "retaliations" are the result, till at last it seems pretty plain that if the companies are to keep control of their own business in such a way as to be answerable to each other in any degree for their methods of conducting it they must do it themselves.

One very strange argument presented by the commission ticket-sellers is that their business serves in some way to protect the public from impostors who sell counterfeit tickets, etc. We would say, on the contrary, that just as soon as it is understood that no one is authorized to sell tickets out of the company's offices, travelers will look with suspicion on any one who may offer one elsewhere, and the swindler's occupation will be gone with the "scalper's."

Retrospect.

Probably a large number of our readers will remember the *Rail Road Advocate*, the publication of which was commenced nearly twenty years ago by Zerah Colburn. Among the effects of a gentleman who has recently died were bound volumes nearly complete of this paper and its successor. These have come into our possession, and as a glance through their pages has interested us very much, we propose taking our readers with us, in a retrospect, in which many who remember the brilliant editor, and the *Advocate* which he conducted, will recall the events of the past years.

The first number of the *Advocate* is dated November 11, 1854. The pages of this number and the whole of the first volume are 18x15 in. in size. The first number, advertisements and all, consists of only four such pages. The subsequent numbers contain eight pages.

On the first page a list is given of the shops then engaged in building locomotives. This list is as follows, those which are still in the same business being marked with a *:

- * Portland Company, Portland, Maine.
- * Amoskeag Locomotive Works, Manchester, N. H.
- * Lowell Machine Shop, Lowell, Mass.
- * Essex Company, Lawrence, Mass.
- * Boston Locomotive Works (now the Hinkley Locomotive Works), Boston, Mass.
- * Globe Locomotive Works, Boston, Mass.
- * Union Works, Boston, Mass.
- * Matfield Company, East Bridgewater, Mass.
- * Taunton Locomotive Company, Taunton, Mass.
- * William Mason & Co., Taunton, Mass.
- * Blanchard & Kimball, Springfield, Mass.
- * Schenectady Locomotive Works, Schenectady, N. Y.
- * Rogers, Ketchum & Grosvenor, Paterson, N. J. (now the Rogers Locomotive & Machine Works.)
- * New Jersey Locomotive & Machine Company, Paterson, N. J. (now the Grant Locomotive Works.)
- * Danforth, Cooke & Co., Paterson, N. J. (now the Danforth Locomotive & Machine Company.)
- * Wm. Swinburne, Paterson, N. J.
- * Breese, Kneeland & Co., Jersey City, N. J.
- * Trenton Locomotive & Machine Works, Trenton, N. J.
- * Richard Norris & Son, Philadelphia, Pa.
- * M. W. Baldwin & Co. (now the Baldwin Locomotive Works), Philadelphia, Pa.
- * Lancaster Locomotive Works, Lancaster, Pa.
- * New Castle Manufacturing Company, New Castle, Del.
- * Ross Winans, Baltimore, Md.
- * Murray & Hazlehurst, Baltimore, Md.
- * A. W. Denmead & Son, Baltimore, Md.

Virginia Locomotive and Car Manufacturing Company, Alexandria, Va.
Anderson, Delany & Co., Richmond, Va.
William Ettinger & Co., Richmond, Va.
Talbot & Brother, Richmond, Va.
Uriah Wells, Petersburg, Va.
Cuyahoga Steam Furnace Company, Cleveland, Ohio.
A. & F. Blandy, Zanesville, Ohio.
C. Cooper & Co., Mount Vernon, Ohio.
Niles & Co., Cincinnati, Ohio.
Moore, Richardson & Co., Cincinnati, Ohio.
A. L. Green & Co., Covington, Ky.
Kentucky Locomotive Works, Louisville, Ky.
H. H. Scoville & Son, Chicago, Ill.
Menomonee Locomotive Works, Milwaukee, Wis.
Palm & Robertson, St. Louis, Mo.

Forty in all, but we are inclined to doubt whether some of these ever really did more than announce that they intended to build locomotives. It will be seen that of these forty shops but nine are now engaged in the same business. Besides those mentioned in the above list the following establishments have since been and are still engaged in building locomotives:

Manchester Locomotive Works, Manchester, N. H.
Rhode Island Locomotive Works, Providence, R. I.
Brooks Locomotive Works, Dunkirk, N. Y.
Porter, Bell & Co., Pittsburgh, Pa.
National Locomotive Works, Connellsville, Pa.
Pittsburgh Locomotive Works, Pittsburgh, Pa.
Dickson Manufacturing Company, Scranton, Pa.

It will thus be seen that twenty years ago there were forty establishments engaged or prepared to engage in this business, while now there are only sixteen. It is safe, however, to say that the capacity of the sixteen present shops is much greater than was that of the forty whose names are given in the above list twenty years ago.

Turning over the page we find an article on "Railroads in 1854," which if republished in the RAILROAD GAZETTE to-day would, most of it, be quite as appropriate to the condition of things existing now as it was to the state of affairs twenty years ago. The following are a few extracts from it: "This year (1854) has been severe upon railroad enterprises. Causes, for which railroads cannot be blamed, operated against them. The country had been growing too fast, making its expenditures a little too deeply, for easy times in the money market." Among the reasons given for the depression existing then, are the following: "Fraudulent disclosures have operated against confidence in railroads. Such influences will probably no more exist." (!) It is hardly necessary to say that this latter attempt at prophecy has not been fulfilled. Another attempt in the same line was more successful. The writer says: "The future growth of the country will correct this (the depression) in time, by developing business enough for the support of each road." The names of the presidents of the railroads terminating in New York are given on the next page. Of these but one occupies the same position now, that is John Taylor Johnston of the Central Railroad of New Jersey.

In the number of November 18 we find a notice of a meeting of "the general managers" of the New England, New York, New Jersey, and Canada roads, at the Astor House, "for the discussion of the general subjects of the policy and management of their roads." Whether the meeting was more successful than those which have been held of late years, the report does not say, but the fact that another "future" meeting is called and nothing said of the proceedings of the first is a little significant.

Many of the subjects discussed to-day so vehemently we find in these same pages, and whether more money should or should not be expended to improve the Erie we find discussed as warmly in the paper of November 25, 1854, as it was under the Watson administration in 1873-74. It is, however, gratifying to see that the effect of years is to silence some disputes. In illustration of this we find an earnest editorial in the Advocate of the date above in which every effort is made to establish the superiority of outside-cylinder locomotives. This dispute is hushed, at least in this country. The paper of Dec. 2 contains an article by George L. Vose advocating the use of iron bridges in place of wood; that dispute, too, is heard no more.

In the number for December 9 we find a report of the meeting of managers referred to above in which the following subjects were offered for consideration:

"The best system of efficiency and safety."
"The best system of discipline, economy, division of service, and constant superintendence."
"The just standard of passenger fares and freight charges."
"The abolition of porky tickets and free tickets."
"The introduction of coal or coke in place of wood, upon locomotives of suitable construction, and the saving of oil."
"The general reform of the railroad system, looking to its permanent influence on the welfare and ultimate destiny of our race (!)"

"The best possible organization of checks and the best system of accountability, by which the interests of the public and of the stockholders may be best protected from fraud, negligence, or incompetency in the administrative departments."

Altogether the above seems to us one of the most violent cases of "scattering" we have recently met with. We wonder that another subject for consideration was not added, and a committee appointed to report on "the correlation of all things and the integrity of moral ideas." It would have been nearly as explicit as some of the above "subjects." Possibly this old report of this meeting in 1854 may give us some explanation, or at least give us an idea, of the reasons why the superintendents' meetings have not since then been more successful. Did any sane person who was present at the meeting referred to believe that it was possible to "consider" such a subject as "the general reform of the railroad system" with any profit at all in such a meeting? The difficulty, or at least one of them, is that the subjects proposed were, and are still, too general in their character. In a deliberative body men conversant with the subject can give their reasons why the standard height of draw-bars of cars should be 2 ft. 9 in. from the top of the rail, or give their reasons for preferring a given form for the section of rails, but when you ask a body of men

RAILROAD EARNINGS, JULY, 1874.

Name of Road.	Mileage.					Earnings.					Earnings per mile.	
	1874.	1873.	Inc.	Dec.	Per c.	1874.	1873.	Increase.	Decrease.	Per c.	1874.	1873.
Atlantic & Great Western.....	571	539	32	.....	6	\$ 408,519	\$ 428,306	.....	\$ 19,877	4%	\$ 715	\$ 795
Atlantic & Pacific and leased lines.....	738	799	.....	61	7%	395,893	383,964	\$ 11,929	.....	3%	526	481
Burlington, Cedar Rapids & Minn.....	424	334	90	.....	27	87,435	88,637	.....	1,202	1%	206	265
Central Pacific.....	1,260	1,218	42	.....	3%	1,268,000	1,214,551	43,449	.....	3%	984	997
Chicago, Milwaukee & St. Paul.....	1,399	1,384	15	.....	1%	749,300	834,341	.....	85,141	10%	539	603
Cleveland, Columbus, Cin. & Ind.....	470	470	.....	.....	.....	327,384	386,268	.....	58,884	18%	696	832
Denver & Rio Grande.....	118	118	.....	.....	.....	41,092	39,613	1,479	.....	3%	348	356
Illinois Central.....	1,109	1,109	.....	.....	.....	624,191	684,840	.....	60,649	8%	563	618
Indianapolis, Bloomington & W'n.....	344	319	25	.....	7%	124,395	131,376	.....	3,119	2%	362	380
Kansas Pacific.....	761	672	89	.....	13%	293,247	323,231	.....	29,984	9%	385	481
Michigan Central.....	812	787	25	.....	3%	519,872	581,168	.....	61,296	10%	640	738
Missouri, Kansas & Texas.....	786	786	.....	.....	.....	245,600	301,318	.....	55,718	18%	312	383
Mobile & Ohio.....	522	517	5	.....	1	119,047	149,094	.....	30,047	20%	228	288
Ohio & Mississippi.....	393	393	.....	.....	.....	282,667	274,297	8,370	.....	3	719	698
St. Louis, Alton & Terre H., main line.....	266	266	.....	.....	.....	104,037	103,841	196	.....	0%	391	390
St. Louis, Iron Mountain & So. B. branches.....	71	71	.....	.....	.....	41,778	47,690	.....	5,912	12%	588	672
St. Louis & Southeastern.....	349	349	216	.....	46	205,250	198,509	6,741	.....	3%	343	423
Toledo, Peoria & Warsaw.....	237	237	.....	.....	.....	92,821	99,524	.....	6,703	6%	260	288
Toledo, Wabash & Western.....	628	628	.....	.....	.....	78,837	105,268	.....	26,431	25%	333	444
West Wisconsin.....	197	197	.....	.....	.....	440,687	488,911	.....	48,224	9%	702	778
Totals.....	12,140	11,662	539	61	4%	\$6,537,975	\$6,924,219	\$386,244	.....	5%	\$539	\$594
Total increase or decrease.....	.....	.....	478	.....	4%	.....	.....	.....	.....	.....	.....	.....

RAILROAD EARNINGS, SEVEN MONTHS ENDING JULY 31.

Name of Road.	Mileage.					Earnings.		Earnings per mile.							
						Increase.		Dec.	Per c.						
	1874.	1873.	In.	Dec	Per c.	1874.	1873.			1874.	1873.	Inc.	Dec	Per c.	
Atlantic & Great Western.....	571	539	32	.....	6	\$2,830,556	\$2,871,001	.....	\$40,445	1%	\$4,957	\$5,326	.....	\$369	6%
Atlantic & Pacific and leased lines.....	738	799	.....	61	7%	2,683,783	2,756,924	.....	73,141	2%	3,637	3,450	\$187	.....	5%
Burlington, Cedar Rapids & Minn.....	424	334	90	.....	27	627,712	572,948	\$54,767	.....	9%	1,480	1,716	.....	235	13%
Central Pacific.....	1,260	1,218	42	.....	3%	7,665,026	7,539,959	125,067	.....	1%	6,083	6,190	.....	107	1%
Chicago, Milwaukee & St. Paul.....	1,399	1,384	15	.....	1%	5,231,145	4,457,330	773,815	.....	17%	3,739	3,221	518	.....	16%
Cleveland, Col., Cin. & Indianap.....	470	470	.....	.....	.....	2,283,076	2,828,068	.....	545,010	19%	4,858	6,017	.....	1,159	19%
Illinois Central.....	1,109	1,109	.....	.....	.....	4,317,291	4,477,249	.....	259,949	5%	3,931	4,037	.....	204	5%
Indianapolis, Bloomington & W.....	344	319	25	.....	7%	947,416	818,595	128,821	.....	15%	2,754	2,568	186	.....	7%
Kansas Pacific.....	761	672	89	.....	13%	1,812,928	1,956,966	.....	144,039	7%	2,382	2,927	.....	545	18%
Michigan Central.....	791	787	4	.....	0%	4,277,058	4,253,220	23,838	.....	0%	5,407	5,404	3	.....	0.1%
Missouri, Kansas & Texas.....	786	662	124	.....	18%	1,681,125	1,742,216	.....	61,093	3%	2,139	2,632	.....	493	18%
Mobile & Ohio.....	522	517	5	.....	1	1,203,318	1,547,701	.....	344,383	22%	2,305	2,994	.....	689	23%
Ohio & Mississippi.....	393	393	.....	.....	.....	1,949,576	2,124,955	.....	175,379	8%	4,961	5,407	.....	446	8%
St. Louis, Alton & T. H. Main Line.....	266	266	.....	.....	.....	679,483	802,351	.....	122,868	18%	2,554	3,016	.....	462	15%
St. Louis, Iron Mountain & So. Branches.....	71	71	.....	.....	.....	287,444	343,815	.....	55,971	16%	4,054	4,842	.....	788	16%
St. Louis & Southeastern.....	349	349	105	.....	28%	1,361,480	1,400,026	.....	38,546	2%	2,891	3,825	.....	934	24%
Toledo, Peoria & Warsaw.....	237	237	.....	.....	.....	691,633	740,463	.....	48,830	6%	1,992	2,122	.....	140	6%
Toledo, Wabash & Western.....	628	628	.....	.....	.....	628,280	673,786	.....	45,506	6%	2,651	2,843	.....	192	6%
Totals.....	11,590	11,120	531	61	4%	\$9,976,709	\$9,095,753	\$1,106,308	2,275,352	2%	\$3,794	\$4,055	.....	\$261	6%
Total increase or decrease.....	.....	.....	470	.....	4%	.....	.....	.....	1,119,044	2%	.....	.....	.....	.....	.....

to discuss "the railroad system looking to its permanent influence on the welfare and ultimate destiny of our race," their ideas go wool-gathering and only the wind-bags are loquacious.

The imperfect knowledge which existed then of the use of coal in locomotives is shown by the fact that it was one of the subjects for discussion, and also by a notice in the same paper of the construction by the Taunton Locomotive Works of "two or three" locomotives with Dimpfel's boiler, "the peculiarity of which is in carrying the water within and the fire around the tubes instead of by the usual plan. The tubes are bent, at their furnace ends, upwards at right angles, so as to come through the sheet which occupies the place of the ordinary crown." The next number of the paper contains a letter from the President of the Norwich & Worcester Railroad Company commending the Boardman boiler. This too was a water-tube boiler, that is, the water was inside the tubes and the fire outside. Both these inventions have subsided into obscurity, and are "heard from no more."

The change in names of existing firms is also curious; thus the well-known firm of Wm. B. Bement & Son was then Bement, Dougherty & Thomas, and William Sellers & Co. was then Bancroft & Sellers.

Looking over an old book or paper sometimes has a very strange effect upon the reader which is perhaps not entirely unwholesome. This occurs when we find that years ago the author of the old volume thought and expressed an idea which the reader had fondly cherished as his own and imagined that he had evolved it out of his inner consciousness from the existing conditions of things. As our readers know, we have frequently called attention to the importance of applying to railroad operation a higher order of engineering skill, and that this is especially important now that competition is growing greater each year and rates for traffic lower. This, we thought, was a truth which was evolved by the present condition of things. From the following extract it will be seen that it was realized as fully twenty years ago as now:

"There was never a time like the present (December 23, 1854,) when so much attention was turned towards railroad engineers and machinists. Railroads have become less profitable than formerly—dividends are being passed; debts have been and are yet accumulating, and railroad stockholders and the public are all looking anxiously in hopes of seeing where their money has gone, and how it is going. They are looking after the administration of the wood-pile, the machine shop, and the store-house; they are looking into the economy of different rates of speeds; of different systems of guarding against collisions, run-offs, and break-downs; everything is now under critical examination."

"Look at the Erie Railroad report for the last year, or, in fact, into any railroad report of almost any company. What are the heaviest items of expenditure? FUEL and REPAIRS OF ROAD. Next to these, by far the heaviest item is for REPAIRS OF ENGINES. These three items alone form nearly one-half of the vast expenditure necessary for working the Erie road. This proportion of expenses is not unusual. The Erie road is only taken as an illustration."

"Now it is very evident that all these expenditures, for repairs and fuel, are directly within the influence of engineers."

It is doubtful whether much has been accomplished in the direction indicated since the time the above was written, and there is no reason for believing that locomotives work any more economically to-day than they did then. During the

same period all other classes of engines have been very much improved, but, excepting in the proportions of locomotives, there has not since then been any change of importance.

Old news sounds strangely at times: thus in the last number of the Advocate of the year 1854 we see it noted of the Railroad Suspension Bridge at Niagara that "it is expected that this great structure will be opened on January 1st," and also that "the double track on the mountain division of the Pennsylvania Railroad between Altoona and Johnstown is finished."

The following item of information concerning the grades on railroads is hardly less valuable now than it was at the time it was published: "Upon the New York & Erie road, on the Eastern Division, and at 'Gulf Summit,' there are maximum grades of 60 feet per mile. By the engineer's report, these are the steepest on that road. The New York Central road leaves Albany on a 93 feet grade. The Western road of Massachusetts has 1 1/2 miles of 83 feet grade, and 5 or 6 miles of 78 feet grades. The Pennsylvania Central road has 10 or 12 miles of 92 feet grades, in crossing the Alleghenies. The Baltimore & Ohio Railroad has over 30 miles of 116 feet grades."

But our "retrospect" has already consumed all the available space, and we are no farther than the first of January, 1855. We will therefore resume it again hereafter."

The Reports of Earnings.

The July earnings, which we report in our table for twenty-one railroads, are not pleasant to look upon. The roads reporting have about one-sixth of the mileage in operation in the United States, and 4 1/2 per cent. more than they had last year, but their receipts are less by \$386,000, or 5 1/2 per cent., and the decrease in earnings per mile is 10.2 per cent. (from \$594 to \$539). Of the twenty-one lines reporting, several of which have an increased mileage, only four show any increase in earnings per mile, and in only one case is this increase considerable (the Atlantic & Pacific and leased lines, 11.4 per cent.) But of the seventeen which show a decrease, no less than twelve have lost 10 per cent. and more, five of them as much as 20 per cent. Three of these have one or more coupons overdue, and this result is by no means reassuring. Quite as noticeable as anything is the absence of reports from leading roads which until lately have published their earnings. The entire mileage reporting is central, Southern and Western, no line appearing which has track east of Buffalo and Pittsburgh.

For the seven months ending with July we have reports from nineteen roads, none of them Eastern. These, with 11,590 miles of road, which is 4 1/2 per cent. less than last year, earned \$1,119,000, or 2 1/2 per cent. less, and the average earnings per mile have fallen 6 1/2 per cent.—from \$4,055 to \$3,794. Four of these show an increase in earnings per mile, amounting to 16 per cent. in the case of the Chicago, Milwaukee & St. Paul; but of the fifteen showing a decrease the rate is more than 10 per cent. in eight cases, and more than 15 per cent. in seven of these. An undue proportion of the roads reporting (no less than five) are carriers between the North and the South, though this is not the largest part of the business of any of

them, probably. Only one of the lines is distinctively a Southern railroad.

Of course all are anxious to see an improvement in earnings, and the present promise of the grain crops is such that we may, we think, reasonably expect an improvement for Western roads. But probably enough these roads will make a worse showing for August than for any previous month, and this they may do without extraordinarily light August earnings. The truth is that last year in the Northwest the August traffic was the heaviest ever known, the roads being almost as busy as they usually are in September. There is no such early movement this year, and if this season's harvest is to crowd the railroads it will probably not be till September. September last year was a very prosperous month for traffic until its last third, when came the panic and inactivity. Farmers have every inducement to market their crops early. Lake and canal freights are absurdly low and prices continue to be remunerative.

Record of New Railroad Construction.

This number of the RAILROAD GAZETTE has information of the laying of track on new railroads as follows:

Portland & Ogdensburg.—Extended from Upper Bartlett, N. H., northwestward 3 miles.

This makes a total of 916 miles of new railroad completed in the United States in 1874, against 2,028 miles reported for the same time in 1873 and 3,485 miles in 1874.

RAILROAD TAXATION is the subject of a circular letter addressed to the assessors of the towns along the New York & Oswego Midland Railroad by Mr. A. S. Hewitt, the Receiver, in which a protest is made against levying taxes on the road in accordance with a law authorizing the towns to do so passed at the last session of the New York Legislature. He quotes his letter to Mr. John G. Stevens, the General Manager, in which he speaks of the law as having doubtful validity, and affirms that as the road has not yet been able to earn its working expenses it cannot be said to have any present value. This reasoning of Mr. Hewitt's is entirely fallacious, resting on the assumption that property has a value only when it earns an income. On this principle unimproved real estate everywhere is valueless and should not be taxed, and so buildings and lands not occupied or rented should be exempt from taxation. Property is taxed to support the government because it requires the protection of the government—as does the Midland Railroad every day and as it has needed peculiar and extraordinary protection more than once; and property has a present value whenever its prospects for ever earning an income are such that people will pay something for it. Now unless the Midland Railroad is a property which will never earn more than its expenses, or such that the expense of supporting it until it has a net income will be disproportionate to its eventual net earnings (in which case the proprietors should and would abandon it immediately) it has a present value; and that it is believed to have such value is conclusively shown by the fact that the securities which represent the property bear a price in the open market amounting in the aggregate to a large sum. The fact that the road has a value, however, does not prove that it is good policy to submit it to town taxation, as there is no pretence of taxing all property in the same way or to the same degree. In this case the General Manager, Mr. Stevens, says that there is no possibility of the road earning more than its working expenses and the cost of some improvements during the coming year, and that "the only result of this taxation will be the closing of the road." It certainly would be a remarkable result of the vast expenditure on this line, the money for which was obtained by assurances that it would certainly be enormously profitable, which assurances of the projectors were indorsed by many of the leading newspapers of New York which actually urged their readers to invest in Midland bonds, if after its track has been completed and its equipment bought it should be found to have absolutely no value as a railroad and have its rails and other materials sold as old stock in order to get any return.

"REPUBLICAN FREEDOM," according to the speech of the Chairman of the Lima Railway Company, as reported in the London Times, of which we have made mention heretofore, caused the people of Peru to resent it as a great infringement when the company insisted that the passengers should buy tickets before getting on the trains. Having discovered that there were 15,000 free passes on the line for the year, that many of these were used over and over again, that the conductors handled pretty much all the receipts and turned in what they pleased, the company ordered that no one should be admitted to a train without a ticket, and to enforce the rule erected strong barriers at the stations. When the Prefect heard of this outrage on the liberties of Peruvians he sent a guard to tear down the barriers, and having removed them actually demanded pay for the work from the company, and, worse than all, made it pay!

CHILI is to have an International Exposition, which is to be opened at Santiago, September 16, 1875. There are special reasons why our manufacturers of machinery, etc., and especially of railroad machinery, supplies and rolling stock, should exhibit their wares at this display. It will, perhaps, have no very large attendance from other than South American countries, but these, and especially the countries of the west coast of South America, will doubtless send it many visitors of an influential class, and South America is perhaps the most promising of all foreign markets for our railroad manufactures. Already they are very largely used there, and our system of construction and equipment is so well adapted to the requirements of these as of almost all countries with thin population and traffic that we ought to have pretty full control of the market. Chili has now (it is a small country: about as large as our seaboard States from Massachusetts to Maryland, inclusive, or

twice as large as Missouri) 785 miles of railroad in operation and 210 under construction, most of it belonging to the State. Among the premiums offered is one for equipment for narrow-gauge railroads.

THE RAILROAD COMMISSIONER'S CONVENTION held in Dubuque last week appointed committees on rates of transportation, on reports, and on legislation. The Illinois, Wisconsin and Minnesota boards were represented, but none of the Iowa executives were present (the State has no commissioners), nor was the Michigan Commissioner. The conference was a sensible measure, especially as a great many railroad companies have lines or parts of lines in the four States mentioned, and it is especially desirable that the railroad year should be the same and the form of reports at least similar in all these and all other States. If we should have annual reports required by the General Government we should secure this, doubtless, and it is probably the only way in which we will ever secure complete and uniform reports for the whole country.

NEW PUBLICATIONS.

Directory of United States Iron Works.—The American Iron and Steel Association, whose facilities for such work are most excellent, has in press a directory of the iron works of the United States, giving the location, name of owner, character of product, etc., of every iron establishment in the country. The work is to be issued about the 1st of September, and sold for three dollars a copy.

Locomotive Reports and Performance.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It seems to me that the present form of expressing the work done by a locomotive is simpler than any other way that I have seen suggested—say, for instance, 40 miles to the ton, that is one ton raised 40 miles high by the consumption of one ton of coal.

Suppose the work performed by a locomotive in making a trip to be equal to raising one ton 200 miles high, and that the locomotive made 16 trips during the month and consumed in that time 80 tons of coal, the work performed would be equivalent to raising one ton 3,200 miles high, which, divided by the number of tons consumed, would give as the result one ton raised 40 miles high with the consumption of one ton of coal; which would be equivalent to a duty of twenty-one (21) million pounds raised one foot high by the consumption of 100 lbs. of coal. Suppose that the work performed by that locomotive during the month, in pulling the train, is equivalent to one ton raised 2,400 miles. There is no difficulty in making an instrument that would at the end of the month show the above-mentioned numbers, viz., 2,400. The remaining duty of one ton raised 800 miles is the work supposed to be performed by that locomotive in transporting itself over the road during the month. This would have to be estimated from experiments.

By placing one of the above-mentioned instruments on each and every locomotive in the country and keeping it there, the performance of a locomotive in pulling the train would be arrived at to a certainty. The getting up of such an instrument is an easy matter, but the introduction of it by the "Reformer" would not be so easy. That there would be an immense saving of fuel there is no question.

JAMES WATERS.

[Our correspondent's meaning is not clear to us. When it is said that an engine ran 40 miles to a ton of coal, it is not meant, as he seems to think, that an amount of work has been done by the consumption of one ton of coal equivalent to raising a ton weight 40 miles high, but it means that a train has been hauled 40 miles by the consumption of one ton of coal. With the present mode of keeping locomotive reports on most roads, we do not know the number of cars in these trains, their weight, nor the power required to haul them. What we proposed in an editorial in the RAILROAD GAZETTE of July 25 was a method of determining the amount of power consumed in hauling a train on each road, and estimating from that the amount of work actually performed by the consumption of a ton of coal. It is quite true, as our correspondent says, that the present form of expressing the work done is very simple. The trouble is that it does not accurately represent the fact which it is intended to express. Pulling a train on one road takes much less power than on others, and on some lines heavy trains can be hauled while on others only light ones can be taken over the grades. What is needed is some method of expressing accurately the amount of work done. We tried in the article referred to to make it clear how this could be done, but from our correspondent's letter we fear we did not make our meaning plain. We think if he will read that article again carefully, he will see what we meant quite as well as he would if we explained further here.—EDITOR RAILROAD GAZETTE.]

The Rail Committee's Report.

TO THE EDITOR OF THE RAILROAD GAZETTE:

"A Junior Member" in your issue of August 1 supposes that in the report of the Committee on Rails read before the American Society of Civil Engineers on the 10th of June, it was asserted "that the rails used upon English lines are more perfectly adapted to the duty required of them than ours are, and hence the rail surface upon which the cars travel may be and is kept in more perfect condition that it can be on our lines, and hence the carriages run more smoothly than ours do."

In the report proper no comparison between English and American rails was made; but the Chairman remarked, outside of the report, "The ballast and all other things being

equal, the double-headed rail, from its resting on iron chains and from its rigidity, must wear out faster than the more flexible single-headed rail resting on wood. American track in the best order is much easier and freer from sharp little vibrations than English track in the best order, an important consideration in passenger roads. Unfortunately the American roads are so badly ballasted and kept in such bad order, that a fair comparison of the plans can seldom be made."

CHAIRMAN.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—Gen. R. H. G. Minty has been appointed Superintendent of the Nashville Division of the St. Louis & Southeastern Railway, with headquarters at Nashville, Tenn. General Minty was formerly on the Louisville, New Albany & Chicago and later on the Ohio & Mississippi. Mr. C. H. Crosby, who has for some time been Assistant General Freight Agent, has been made General Freight Agent, with headquarters at St. Louis.

—The first board of directors of the new Bloomington, Bloomfield & St. Louis Railroad Company is as follows: James Small, C. F. Jodds, J. B. Mulkey, W. H. Irwin, J. N. Conly, Hughes East, Wm. E. Mason, Phil. Law, Nelson Connett, Wm. Baker, Joseph Combs, Benjamin F. Adams and Alex. Smith.

—The Connecticut board of Railroad Commissioners has organized for the ensuing year by electing Andrew Northrop, Chairman; George W. Arnold, Secretary, and George T. Utley Clerk. The Commission will hereafter have a permanent office at No. 67 Charter Oak Life Building, Hartford, Conn.

—At the annual meeting of the Indianapolis Belt Railroad Company in Indianapolis, August 12, the following directors were chosen: A. J. Bright, J. H. Devereux, T. D. Kingan, H. C. Lord, W. B. McKee, J. F. Richardson, Horace Scott, F. H. Short, B. E. Smith, W. W. Smith, John Thomas. The board includes representatives of all the lines entering Indianapolis.

—Mr. James Taynton, formerly of Port Jervis, N. Y., has been appointed Master Mechanic of the Wilmington & Reading Railroad, with office at Coatesville, Pa.

—The new board of directors of the Rochester, Nunda & Pennsylvania Railroad Company has elected the following officers: President, Alfred Lockhart; Vice-President, George W. Aldridge; Treasurer, C. L. Bingham; Secretary, Henry H. Seymour; Attorney, D. P. Richardson.

—Ira Harris, Jr., of Decatur, Mo., has been chosen President of the Mississippi Valley & Western Railroad Company.

—It is stated that Mr. Schermerhorn, late General Dispatcher, will succeed Mr. Wm. H. Griggs, who has resigned, as Master Mechanic of the New York & Oswego Midland Railroad. Mr. Theodore Morford is appointed Foreman of the Middletown shops, in place of John Minchell, transferred to the Norwich shop.

—The Western Railroad Bureau, consisting of the seven Western Commissioners appointed by the trunk lines under the agreement adopted at the St. Louis meeting, was organized at Indianapolis, August 14, by electing Gen. George B. Wright, of Columbia, O., President.

—At the annual meeting of the Nashville, Chattanooga & St. Louis Railroad Company, in Nashville, Tenn., August 12, the following directors were elected: E. W. Cole, John M. Bass, G. M. Fogg, John Frizzell, John Porterfield, G. M. Fogg, Jr., B. F. Wilson, Nashville, Tenn.; E. L. Jordan, J. W. Childress, N. C. Collier, Murfreesboro, Tenn.; Thomas C. Whiteside, Thomas Lipscomb, Shelbyville, Tenn.; W. S. Huggins, Tullahoma, Tenn.; Vernon K. Stevenson, Adrian Iselin, New York. The only new directors are Messrs. Collier and Iselin, who replace G. I. Patton and J. Pryor.

—At the annual meeting of the Atlantic & Pacific Railroad Company in New York, August 19, the following directors were elected: Thomas T. Buckley, Joseph Seligman, Andrew V. Stout, Wm. H. Coffin, David Salomon, Andrew Pierce, Jr., Cornelius J. Bergen, Henry F. Verhuesen, New York; Clinton B. Fisk, James D. Fish, D. R. Garrison, Charles P. Chouteau, Thomas W. Pierce, St. Louis. The new directors are Messrs. Bergen, Verhuesen, Buckley, Fish, Chouteau and Pierce, who replace J. Edgar Thomson (deceased), Thomas A. Scott, F. B. Hayes, Uriel Crocker, Oliver Ames and A. L. Dennis. The Boston element in the board has entirely disappeared, and Mr. Salomon is the only representative left of the Pennsylvania, which last year had four.

PERSONAL.

—Mr. A. Mason Peek, of Albany, N. Y., for many years Assistant Chief Engineer of the New York Central & Hudson River road, died August 11. He was in the service of the Delaware & Hudson Canal Company at the time of his last illness, and was in good health up to within forty-eight hours of his death.

—Mr. L. J. Seargeant, the new Associate Manager of the Grand Trunk Railway, arrived in New York from Liverpool, August 12, and shortly afterwards left for Montreal.

—Lord Caldwell, Deputy Chairman of the Great Northern Railway Company, arrived in New York recently, his purpose being to study and investigate the railroad systems of the United States and Canada.

—Mr. C. H. Hallock, for four years past Agent in Chicago for the Union and Central Pacific roads, has resigned and will go into other business.

—Mr. J. T. Dodge, Chief Engineer of the Chicago, Milwaukee & St. Paul Railway, sailed for Europe on the Celtic on the 15th.

—A telegram from Louisville, Ky., announces the death in that city, August 18, of Mr. H. D. Newcomb, President of the Louisville, Nashville & Great Southern Railroad Company. The cause of his death was paralysis.

—Mr. Howard Fry, formerly on the Grand Trunk, and for some months past on the Erie Railway, has resigned his position as Supervisor of Locomotives on the latter road.

—George Edmunds, Jr., has resigned his position as President of the Mississippi Valley & Western Railroad Company.

—Mr. G. W. Vaughn is Chief Engineer and Superintendent of the Wyandotte, Kansas City & Northwestern Railroad.

—William Fairbairn, the eminent engineer, to whose labors and studies iron industry owes so much, and who especially enlarged our knowledge of the strength of iron, died on Tuesday, the 18th inst., at the age of 85. He was a Scotchman by birth, learned his trade as a machinist in a colliery, but early became eminent as an engineer, having been the pioneer in the use of iron for various important purposes. His experiments on iron and his records of them have made his name as familiar perhaps as that of any modern engineer with his profession in all countries.

—Mr. James C. Clarke, who for more than a year has superintended the transportation of the Erie Railway, exercising his functions under different titles, "Superintendent of Transportation," "Third Vice-President" and "General Manager,"

has resigned his position. A Baltimore paper says that he has accepted the superintendency of the Toledo, Wabash & Western, and elsewhere it has been stated that he will go to the Toledo, Peoria & Warsaw.

TRAFFIC AND EARNINGS.

—The earnings of the Denver & Rio Grande Railway (main line) for the first week in August were: 1874, \$8,423.69; 1873, \$8,551.34; decrease, \$427.65, or 5 per cent.

—The earnings of the Shenandoah & Allegheny Railroad for the half year ending June 30 were: 1874, \$137,663.64; 1873, \$37,459.92; increase, \$100,203.72, or 267% per cent. The increase is caused mainly by a very large increase in the production of oil in the country served by the line. The earnings per mile in 1874 were \$4.172; in 1873, \$1.135.

—The earnings of the Toledo, Wabash & Western Railway for the first week in August were: 1874, \$122,794; 1873, \$146,420; decrease, \$23,626, or 16% per cent.

—The earnings of the Atlantic & Pacific and leased lines for the first week in August were: 1874, \$106,488; 1873, \$100,099; increase, \$6,389, or 6% per cent.

—The earnings of the Midland Railway of Canada for the seven months ending July 31 were: 1874, \$177,418; 1873, \$184,658; decrease, \$7,240, or 3% per cent.

—The receipts of coal at East St. Louis for the month of July were as follows:

	Tons.
Belleville & Southern Illinois R. R.	22,920
Illinois & St. Louis	15,072
St. Louis & Southeastern	13,578
Ohio & Mississippi	12,484
Vandalia Line	10,069
Ohio & St. Louis	498
Total	74,621

—The wheat exports from San Francisco for July were 15 cargoes, in all 14,157 tons. Two cargoes (1,200 tons) went to the Cape of Good Hope, the rest to Liverpool. The flour shipments were 33,600 barrels, of which 10,748 went to England, 11,979 to China, 4,000 to the Cape of Good Hope, and the balance chiefly to Central and South America. As compared with July, 1873, there was a decrease of 12-16 per cent. in wheat, an increase of 66% per cent. in flour, and reducing flour to wheat, an increase of 0% per cent. in the total. The value of the wheat was \$473,678, and of the flour \$171,705, a total of \$645,383.

—The coal tonnage of the Pennsylvania Railroad Company's New Jersey lines for the seven months ending August 1 was 717,861 tons, of which 160,404 tons went to Coal Port and 392,383 tons to South Amboy for shipment, and 165,074 tons was delivered at way points.

—The tonnage of anthracite coal over the lines given (whose year begins December 1) was as follows for the eight months ending August 1:

	1874.	1873.	Inc. or Dec.	P. c.
Philadelphia & Reading	3,621,969	3,899,748	Dec. 277,779	7%
Schuylkill Canal	362,802	385,310	Dec. 22,508	5%
Lehigh Valley	2,651,890	2,644,130	Inc. 7,760	0%
Totals	6,636,661	6,929,188	Dec. 292,527	4%
Pennsylvania & New York	461,626			

—The amount of tolls on the New York State canals from the opening of the season up to August 8 was: 1874, \$1,339,071.49; 1873, \$1,259,994.20; increase, \$79,077.29, or 6% per cent.

—The earnings of the Great Western Railway of Canada for the week ending July 24 were: 1874, \$17,216; 1873, \$22,367; decrease, \$5,151, or 23 per cent.

—The earnings of the Grand Trunk Railway for the week ending July 25 were: 1874, \$39,000; 1873, \$37,800; increase, \$1,200, or 3% per cent.

—The shipments of peaches northward through Wilmington, Del., from the beginning of the season up to August 13 were 512 car loads or 256,000 baskets.

—The earnings and expenses of the Union Pacific Railroad for June were as follows:

	1874.	1873.	Decrease.	P. c.
Earnings	\$902,881 48	\$909,963 68	\$6,982 20	6%
Expenses	408,418 52	477,118 04	68,699 52	2%
Net earnings	\$494,462 96	\$552,745 64	\$58,282 68	10%

For the six months ending June 30, the following report is made.

	1874.	1873.	Increase.	Decrease.	P. c.
Earnings	\$4,563,632 77	\$4,582,976 27		\$19,343 50	0.7-16
Expenses	2,422,102 72	2,452,914 83		\$69,181 89	3
Net earnings	\$2,141,530 05	\$2,230,061 44		\$88,531 39	4

The expenses were 53.07 per cent. of earnings in 1874 and 51.94 per cent. in 1873. The gross earnings were \$4,422 per mile in 1874, and \$4,441 in 1873. The increase in expenses this year is reported to have been largely caused by the cost of filling up trestle bridges, a permanent improvement, which is now nearly completed.

—The tonnage of bituminous coal over the lines given for the seven months ending August 1, was as follows:

	1874.	1873.	Inc. or Dec.	P. c.
Huntington & Broad Top	190,364	263,292	Dec. 73,928	27%
Clearfield coal over Tyrone				
Div., Penn. R. R.	373,477	331,356	Inc. 42,121	12%
Totals	563,841	594,648	Dec. 30,807	5%
Penn. & N. Y. (eight months)	187,865			

—Of the flour and grain shipments from Chicago, Milwaukee, Toledo, Detroit, Cleveland, Duluth, St. Louis and Peoria for the week ending August 8, 44 per cent. of the flour, 4% per cent. of the wheat, 15% per cent. of the corn, and 78 per cent. of the oats were by rail.

—Of the shipments of grain from Buffalo for the week ending August 8, 40 per cent. was by rail.

—The earnings of the Nashville, Chattanooga & St. Louis Railroad for the year ending June 30, 1874, were as follows:

	1874.	1873.	Inc. or Dec.	P. c.
Earnings (\$5.487 p. r mile)	\$1,876,632.97			
Expenses (71.6 per cent.)	1,343,757.32			
Net earnings (\$1.552 per mile)	\$532,875.65			

As compared with the previous year, there is a decrease of \$21,567.70, or 18% per cent., in gross earnings; a decrease of \$39,180.67, or 2% per cent., in expenses, and a decrease of \$22,357.08, or 4 per cent., in net earnings.

THE SCRAP HEAP.

Railroad Manufactures.

The St. Louis Rail Fastening Company's Works contain three heating furnaces, two trains of rolls and three spike machines. The yearly capacity of the works is 6,000 tons of spikes and bolts.

The Springfield (Ill.) Rolling Mill is running steadily on iron rails.

The American Bridge Company of Chicago has the contract for the roof of the new Union Pacific depot at Omaha.

The Atlantic Car Works at Salem, Mass., which have been closed some time while the affairs of the company were being wound up, will be sold at auction August 25.

OLD AND NEW ROADS.

St. Clair & Carondelet Bridge.

The bridge which this company desires to build over the Mississippi at Carondelet is a truss bridge with three spans of 400 feet each. In order to do this it will be necessary to secure an amendment to the present law, which requires a span of 500 feet. If such an amendment cannot be secured, then an arch bridge will have to be built. There is very strong opposition both to the 400-foot span and to the arch, and in fact to any bridge at all at that place. The St. Louis Merchants' Exchange has made a protest against anything but a truss bridge of 500 feet span.

Waynesburg & Washington.

It is now proposed to build a narrow-gauge road from Waynesburg, Pa., northward about 25 miles to Washington, where connection will be made with the Chartiers Railroad to Pittsburgh.

Union Pacific.

Officers of this company state that all the large holders of income bonds have exchanged them for the new sinking fund bonds, and that the smaller holders are coming forward rapidly.

A New International Bridge.

Two meetings have been held of the corporators of the Niagara River Transit Company, which is to build a new bridge over or a tunnel under the Niagara River near Buffalo. A plan of organization was presented, but nothing was effected. Plans and estimates for a tunnel, which were made in 1855, were presented. The general feeling was in favor of a tunnel rather than another bridge.

South Mountain.

The surveys for the branch line from Strasstown, Pa., to Reading have been completed and a contract let for the grading. The branch is 19 miles long. Work on the main line, from Harrisburg to Hanaburg, is progressing steadily.

Wyandotte, Kansas City & Northwestern.

This is now the name of the company the completion of 10 miles of whose road, from Kansas City to Independence, was recorded two weeks ago under the head of Kansas City, Independence & Lexington. Regular trains are running over this finished section. It is proposed to build 34 miles more of road, from Independence east to the coal fields of Lafayette County, this fall. The gauge of the road is three feet.

Chicago, Burlington & Quincy.

The suit against this company for violation of the Illinois law is to be tried in the Bureau County Circuit Court at the term which begins August 30.

Rensselaer & Saratoga.

It is said that a new line is to be built from Mechanville, N. Y., northward along the Hudson to Fort Edward, a distance of about 27 miles. For all business going north and to the New York & Canada road this line would be about 10 miles shorter than the present one through Saratoga.

Maryland Canal.

The old project of an extension of the Chesapeake & Ohio Canal to Baltimore has lately been revived. The Maryland Legislature at its recent session chartered the Maryland Canal Company to build a canal some 28 miles long from the Chesapeake & Ohio Canal to a point on the Patuxent River near Baltimore. The company is authorized to complete its organization as soon as \$1,000,000 is subscribed to the stock, and the City of Baltimore is authorized to endorse canal bonds to the amount of \$1,500,000.

Several routes have been surveyed for the canal, one as long ago as 1828.

Chesapeake & Ohio.

The company urges its bondholders to accept a proposal for funding their coupons and otherwise settling their claims against the company which differs somewhat from that made last fall, chiefly in requesting the holders of the 7 per cent. bonds to accept income bonds for 75 per cent. of their holdings and the interest for three years on the other 25 per cent., whereas the old proposition proposed that the whole amount of the 7 per cent. mortgage bonds should be funded into income bonds.

It also proposes that the creditors who hold the 6 per cent. first-mortgage bonds as collateral security accept them for their claims and fund the interest for two years like the other holders of these bonds; that those creditors who hold the 7 per cent. bonds as collateral take income bonds at 85 for three-fourths of their claims, the 7 per cent. mortgage bonds for the rest, and fund the interest on the latter for three years; and that those creditors who hold no collateral accept in payment income bonds at 85. The income bonds are dated October 1, 1873, payable 20 years after date, with interest at 7 per cent., payable out of surplus income and accumulating until paid.

The surplus earnings during the period of funding the coupons is to be applied to paying off arrears for labor, etc., increasing equipment and terminal facilities, and otherwise completing improvements needed to enable the road to do its work economically.

A large proportion of the bondholders and other creditors are said to have accepted this proposal.

Lake Michigan & Upper Mississippi Rates.

The following are the resolutions adopted at a recent meeting of railroad and steamboat line managers regarding rates from points on the Mississippi above La Crosse to Chicago, Milwaukee and Green Bay, which have been very low and irregular for some time on account of competition between the steamboat lines:

Resolved, That, commencing August 10, 1874, merchandise rates of April 7, 1874, are restored.

Resolved, That, commencing August 10, 1874, the rate on grain and flour from river points above La Crosse to Lake Michigan (Chicago, Milwaukee and Green Bay) shall be 25 cents per 100 pounds rail and river, and 27 cents per 100 pounds all rail.

Resolved, That grain and flour rates from points between Dubuque and St. Paul to Chicago, Milwaukee, and Green Bay shall be:

	All rail, River and rail, cents.	cents.
Above Dubuque	27	25
Dubuque	25	23
Bellevue and Sabula to Rock Island, inclusive	23	21

The grain rates are 3 cents per 100 less than the April rates. Wheat forms the chief traffic to Lake Michigan, and the all rail rates above are 15.6, 15, 12.9 cents per bushel; the rail-and-river rates 1.2 cents per bushel less.

Mineral Range.

Under date of June 1 the directors published a report of the condition and works of this road during the time elapsed since its completion:

"The main line is constructed on a gauge of three feet, from Hancock to Calumet, with an extension to the smelting works of the Detroit & Lake Superior Copper Company on Portage Lake, a distance in all of 13 miles, with three-quarters of a mile of sidings and switch tracks; is equipped with two Baldwin locomotives, two passenger cars, eighteen freight cars, and a full complement of auxiliary cars, buildings, turn tables, and other appliances for the convenient operation and repair of

the road, at a total cost of \$308,282.41, being \$23,714.08 per mile of main line."

The credit side of the balance sheet, June 1, 1874, is as follows:

Capital stock, full paid	\$101,525 00
First-mortgage, 8 per cent. bonds due 1888	165,700 00
Income amount	22,837 13
Floating debt, bearing 10 per cent. interest	54,466 21
" " bearing no interest	26,475 47
	\$371,023 81

"The receipts and expenses from the operating of the road from October, 1873, to date, have been:

	Gross receipts.	Operating expenses.	Per cent.	Net earnings.
Three months of 1873	\$19,423 32	\$11,446 72	58.935	\$7,976 60
Five months of 1874	36,388 13	21,506 60	59.103	14,881 53
Totals	\$55,811 45	\$32,953 32	59.019	\$22,858 13

Per mile of road..... \$4,293 11 \$2,574 87 \$1,718 24

"Operating at the same rate for twelve months would give, for the year ending October 1, 1874, net earnings of \$34,285.69, being \$2,637 36 per mile of road, or 11 12-100 per cent. on entire cost.

"With this exhibit must be considered not only the heavy proportion of operating expenses to gross receipts common to all new roads, but also the fact that the eight months, on the business of which the years estimate is based, embraced five and one-half months of winter, with its formidable snows, obstacles of the first magnitude in operating railroads in the Upper Peninsula."

A report for each of the first five months of 1874 shows aggregate gross receipts \$36,338.13, working expenses \$21,506.60, net earnings \$14,831.53.

The company has issued \$200,000 8 per cent. first-mortgage bonds, of which \$165,700 is sold. The balance is offered at 80 with accrued interest. All issued, the debt will be at the rate of \$15,385 per mile, requiring net earnings of \$1,231 per mile to cover the interest.

Freehold & Keyport.

Work has been suspended on this road for some time, and now the contractor, Mr. Schultze, wants to surrender his contract. A meeting of the stockholders was held recently, but no action was agreed upon.

Central Pacific.

The Martinez (Cal.) *Gazette* of August 8, says: "The company has again put a corps of engineers in the field for a survey of what is termed the air-line route from Sacramento, crossing the middle ground of Suisun Bay, from the north side to a point on this side above Bay Point. This line was surveyed and soundings in crossing the bay taken some two years ago with much care and accuracy by a corps under Engineer Guppy, who has also charge of the survey now to be made."

Philadelphia & Baltimore Central.

This company recently notified the Post Office Department of its intention to cease carrying the mails unless an additional compensation was paid. The Department has consented to have the mails re-weighted and compensation given on the basis of the new weight, and the mails continue to be carried meanwhile.

Allegheny Valley.

The adjourned meeting of the creditors was held in Pittsburgh, Pa., August 11, and the report of the committee was received. The committee reported that they had submitted to the officers of the Pennsylvania Railroad Company the following basis of settlement:

1. That the Allegheny Valley Railroad Company shall apply to the payment of the interest on the income bonds all its surplus earnings, after providing for existing mortgages and operating expenses only.

2. That there shall be devoted to the payment of the interest and principal \$3,500,000 income bonds, the amount due creditors other than the Pennsylvania Railroad and the Philadelphia & Erie Railroad, one-tenth of the gross receipts for freight to and from the Allegheny Valley Railroad and over the Pennsylvania Railroad, the Philadelphia & Erie Railroad and the Northern Central Railroad. This one-tenth shall be placed with the trustees of the mortgage, one of whom shall be the Safe Deposit Company of Pittsburgh.

3. That for any deficiency in interest on the income bonds, by reason of the Allegheny Valley Railroad failing to realize a sufficient amount, the trustees shall apply (out of this 10 per cent.) a sufficient amount to pay the deficiency in interest, and the remainder shall be applied to the purchase of the \$3,500,000 outstanding bonds by advertisement.

4. The entire amount of income bonds under this trust shall be \$10,000,000, of which a sufficient amount shall be used for the payment of existing debts at par, and out of the remainder the Pennsylvania Railroad shall be entitled to a sufficient amount a par as may be necessary for her advances, and the Philadelphia & Erie Railroad Company for indebtedness due to it.

5. These bonds to run for 20 years.

6. The interest to be at the rate of 7 per cent. per annum.

This paper was referred to the Board of Directors of the Pennsylvania Railroad Company and accepted by them. The committee stated its belief that with proper management the net earnings of the road would be nearly sufficient to pay interest on the income bonds, leaving the 10 per cent. rebate to be applied to canceling them. A formal contract was drawn up in accordance with the above memorandum.

The creditors approved the report, and the contract was signed by parties representing \$5,000,000. The signatures for the remaining \$1,300,000 will, it is said, be given within a short time.

It will be seen that there is no lease of the road to the Pennsylvania Railroad Company, as was stated in the telegrams from Pittsburgh last week.

Bay City & Fruitport.

A preliminary survey has been made from Midland, Mich., southwest to St. Louis. The company is trying to get possession of the line from Midland east to Bay City, which is already graded.

Easton & Amboy.

Work on the eastern section is progressing rapidly. On the western section the headings in the Musconetcong tunnel are advancing steadily and are now about 1,000 feet apart. About 300 men are employed on the tunnel.

Chippewa Falls & Western.

Work here commenced on the construction of this line from Chippewa Falls, Wis., to the West Wisconsin at Eau Claire. McDougall & Reilly, of Minneapolis, Minn., are the contractors.

Cincinnati Southern.

A commission of United States engineers consisting of Col. W. S. Merrill and J. H. Simpson and Major Suter has been examining the plans and location of the proposed new bridge over the Ohio at Cincinnati, which is to be built for this road. Much testimony was taken from river men and others. There was much difference of opinion, the steamboat men desiring to have the channel span near the Kentucky shore, while the railroad engineers have located it near the Ohio shore. The river men also want a channel span of 500 feet. All the witnesses favored a location about 600 feet above the one chosen.

This, it is said, will involve \$200,000 additional cost to the railroad on the Kentucky side, and probably as much more on the Ohio side, besides making the approaches less convenient. The report of the board of engineers will not be made public until it has been submitted to the Secretary of War.

Knoxville & Ohio.

It is stated that this road is to be transferred to a new company composed mainly of English capitalists, who will extend the road northward to the Tennessee line. It is in operation for 31 miles, from Knoxville, Tenn., northward to Coal Creek.

Atlantic & Pacific.

The contract for supplying the coal used on this road and its leased lines has been let to the Moniteau Coal and Coke Company.

Frankford & Breakwater.

An extension about four miles long is being built from Frankford, Del., south to the Maryland line. Some trouble was caused by the failure of a sub-contractor to pay his men, and there was almost a riot, but the matter was finally adjusted.

Dividends.

Dividends have been declared by the following companies:

Central Pacific, 5 per cent. out of the earnings for the ten months ending June 30, 1874, payable August 15.
Chicago & Alton, 5 per cent. semi-annual on both preferred and common stock, payable September 1. Transfer books are closed from August 22 to September 2.

Hannibal & St. Joseph.

Arrangements had been nearly completed for the issue of new Missouri State bonds in renewal of those issued in aid of this company which become due this year and next, when it was discovered that the company had not filed its acceptance as required by the law providing for the issue. Steps have been taken to have this section of the law complied with.

Galena & Southern Wisconsin.

An agent has been sent east to purchase iron and locomotives, and a contract has been closed with the Litchfield (Ill.) Car Works for cars. It has been decided to use light T rail instead of the wooden or angle-iron rail, both of which were talked of.

Port Royal.

Arrangements have been made for a regular weekly line of steamers from New York to Port Royal, to run in connection with this road. The first steamer will leave New York August 27.

Buffalo & Jamestown.

Work has been resumed on the line from Gowanda, N. Y., southward. A considerable force is employed at the Gowanda bridge and the grading near there, and the right of way is being cleared off from that point to Dayton.

Spartanburg & Asheville.

The preliminary surveys for this projected line from Spartanburg, S. C., northwest to Asheville, N. C., have been completed. Two lines were surveyed and estimates made for both. The estimated cost of the line by way of Columbus, N. C., is \$1,000,757, and of the line by the Warrior and North Facolet, \$365,280.

Memphis & Kansas City.

Efforts are being made to secure the building of this road from Memphis, Tenn., through Arkansas to Batesville, and thence to the Cairo & Fulton at Jacksonport. Agents are securing subscriptions along the line, which are to be payable in money, land, ties or labor.

Davenport & St. Paul.

The First National Bank of Davenport, Ia., has begun a suit against the Davenport Railway Construction Company to recover some \$16,000, and asks that the company be required to produce its books and show in what manner its stock was paid for and what disposition has been made of the proceeds.

Lapsed Land Grants.

The following is a list of railroad land grants which have lapsed, owing to the failure of the companies to fulfill the conditions, and which under the recent opinion of the Attorney-General will be thrown open to sale and settlement:

Railroads.	Miles.	Acres.
Alabama & Florida.....	180	324,000
Jackson, Lansing & Saginaw.....	50	180,000
Jacksonville, Pensacola & Mobile.....	160	600,000
Mobile & Girard.....	140	300,000
North Louisiana & Texas.....	90	252,000
Pensacola & Louisville.....	43	165,000
St. Croix Grant.....	220	1,180,000
Tennessee & Coosa Rivers.....	35	67,784
Total.....	898	3,106,784

The number of miles appears to indicate the mileage which the companies have failed to build.

Morgan's Louisiana & Texas.

In order to secure the road from such damage by flood as it received this year, nearly the whole of it is to be raised three feet above the old grade. The work is now in progress. The country through which it passes is very level.

Utica & Black River.

This company has commenced action against the towns of Champion, Rutland and Philadelphia, in Jefferson County, N. Y., to compel a reduction of the assessed value of its property, which, it is claimed, is excessive.

Georgia.

The directors of this company met in Augusta, Ga., August 12, and decided to authorize the proper officers to issue \$250,000 in bonds, if needed.

Memphis, Carthage & Northwestern.

Mr. Burgess, who built this road, has begun suit to recover a balance of \$108,000 due him on his contract.

United States Contracts.

Capt. A. M. Damrell, Corps of Engineers, will receive proposals at his office, No. 38 Church street, Mobile, Ala., until noon of September 19, for dredging 350,000 cubic yards, more or less, in Mobile Bay.

Lieut.-Col. J. G. Foster, Corps of Engineers, will receive proposals until 10 a. m. of August 24 for dredging in Salem Harbor.

Wheeling & Lake Erie.

A conference was recently held in Sandusky, O., between officers of this company and citizens of Sandusky and Toledo. The object was to decide which city should be the Lake terminus of the road, but no definite result was reached. The road will go to the place which offers the largest subscriptions.

New Orleans, Mobile & Texas.

The Governor of Louisiana, as trustee for the State, gives notice that he will sell all that portion of the road west of the Mississippi River, under authority of the second mortgage given to the State. The sale will be held in New Orleans September 30, and will be for cash. It will also be made subject to the first mortgage of \$12,500 per mile, and bids will be

considered as being for the value of the road over that incumbance. The sale will be made in two lots, first the finished portion of the road, about 70 miles, and second, the unfinished road-bed, real estate and other property from the end of the track to the Sabine River.

Louisville & Nashville.

In the case of this company against Sumner County, Tenn., to enjoin the county from taxing the road, the Circuit Court has decided that the property of the company is liable to taxation. The case will be taken to the Supreme Court.

Southwestern & Rio Grande.

The first 10 miles of the road southwest from Shreveport, La., is to be located at once and the grading contracted for. Arrangements have been made for the iron.

Utica, Ithaca & Elmira.

The Utica (N. Y.) Herald says: "Work on this road, discontinued on account of the illness of Hon. Ezra Cornell, has been resumed. The force of men employed now is small, and operations are confined to the road between Horseheads and West Junction, but it is intended to increase the force and extend operations soon. Sufficient materials have been purchased to lay the track to West Junction, to which place trains will run in about one week."

Baltimore & Drum Point.

It is stated that an error has been discovered in the engrossed copy of the law passed in regard to it at the last session of the Maryland Legislature, which enacts that if the road is not finished in five years from January, 1870, the charter will be vacated. The act repeals all acts passed in relation to it. The company has now a little over four months to complete the road in or lose the charter.

North Carolina.

In 1868 a suit was commenced against George W. Swenson and the members of the board of directors who, just before the close of the war, exchanged with Swenson a lot of State bonds for Confederate bonds. The Supreme Court has just given judgment against Swenson for \$20,000, the value of the old State bonds.

Ohio & Baltimore Short Line.

The Washington (Pa.) Reporter says that work on this line has been suspended, the contractors have left and all the affairs of the road have been closed up. The road was an extension of the Wheeling, Pittsburgh & Baltimore from Washington, Pa., east to the Pittsburgh, Washington & Baltimore at Layton's.

Mobile & Montgomery.

The foreclosure sale of this road will take place at Montgomery, Ala., November 16. By the terms of the decree of foreclosure no bid can be received for a less amount than a sum sufficient to pay off the first mortgage bonds and interest and the costs of the suit. The amount will be announced at the time of the sale.

Lake View & Collamer.

This road is to be seven miles long, from Cleveland, O., east to Euclid. It is to be of 3-foot gauge and is intended for suburban passenger travel. The contract for building the road, all complete except depot and equipment, was let recently to F. G. Palmer for \$54,700, the work to be done by July 1, 1875. Work has been commenced.

Portland & Kennebec.

In the case of Richard Sullivan, trustee, against this company, the United States Circuit Court at Portland, Me., has given a decision affirming the validity of a foreclosure of a mortgage to second bondholders.

Portland & Ogdensburg.

The track is now laid to a point three miles west by north from the late terminus at Upper Bartlett, N. H., and 75 miles from Portland. Trains are running to the new terminus.

Nashville, Chattanooga & St. Louis.

At the annual meeting in Nashville, Tenn., August 12, it was resolved to hold the annual meeting hereafter on the Wednesday after the second Tuesday in September, instead of August as heretofore. It was also resolved that hereafter proxies should be renewed annually and be good for only one meeting.

New York & Harlem.

Some time since Mayor Havemeyer, of New York, refused to sign a warrant for the City's one-half of the certificate given by the Superintendent Engineer in May last of the amount actually expended in the work of lowering the tracks on Fourth avenue in that city, commonly known as the Fourth Avenue Improvement. The Mayor took the ground that the law requiring the City to pay one half the cost of the improvement was unconstitutional, and therefore void. The Supreme Court has now, on application of the Company, decided that the law is constitutional, and has issued a peremptory mandamus to compel the Mayor to sign the warrant.

North Pennsylvania.

Work is to be commenced very soon on the branch line which is to connect at the Delaware with the Delaware River & Bound Brook road and form a part of the new line between New York and Philadelphia.

European and North American.

In the trespass suits brought to decide the title to some 280,000 acres of public land in Maine, the courts have decided that the title is in the State, and have accordingly given judgment of trespass against the parties leasing timber rights from the railroad company.

Canada Pacific.

The branch line from Fort Garry, Manitoba, to Pembina, on the Minnesota border, is to be put under contract at once and a call for proposals will shortly be issued.

Pennsylvania—New York Division.

The new passenger depot in Jersey City approaches completion. The roof is all up, the platforms, which are of concrete, are nearly finished, and the tracks are being laid. The waiting room has been in use for several weeks. Two slips out of six in the new ferry house are in use, a third will be ready in a few days, and the others are making good progress. There is one slight drawback to the new arrangements, and that is the long distance passengers are obliged to walk from the ferry boats to the cars, which is perhaps unavoidable.

New Jersey Midland.

A steady increase in both freight and passenger business is manifest. The condition of the road is reported to be fair, and it is being gradually improved as the company's means permit. Considerable ore business is expected from the new Green Pond Railroad, which is likely to be a valuable feeder.

New York Central & Hudson River.

Application was recently made for an injunction to prevent this company from laying its additional tracks through Rochester across the streets at grade. A temporary injunction was granted pending the further trial of the case.

About 200 men are at work grading and filling the lately acquired property at Sixtieth street in New York, and a bulkhead 1,300 feet long on the water front is in progress. The property will have an area of about 25 acres when the filling in is completed.

The large grain elevator will be located at the southern end of the bulkhead, and three freight piers, 450 feet long and 80 feet wide, will be run out into the river. Three tracks will be laid on each. A large part of the tract will be used for stock-yards, work on which will be begun as soon as the grading is done.

Jersey City & Albany.

Work has been commenced on the extension from Tappan town to Haverstraw, N. Y., a small force being employed on some of the heavier cuttings. The contract calls for the completion of the extension, 15 miles long, by January 1, 1875.

Bloomington, Bloomfield & St. Louis.

This company filed its articles of association with the Secretary of State of Indiana, August 13. The capital stock is to be \$4,000,000, and the road to be built is from Bloomington, Ind., a little south of west to St. Louis, a distance of about 200 miles.

Indianapolis, Cincinnati & Lafayette.

The agreement between this company and the Pittsburgh, Cincinnati & St. Louis has, it is said, been finally concluded. It provides for pooling all earnings, both freight and passenger, on through business between Chicago and Cincinnati, Chicago and Louisville, and Chicago and Indianapolis. There is to be no change in rates for the present.

Palisade & Eureka.

A contract for 75,000 ties has been made with the Sierra Nevada Lumber Association. These ties are to be 5 by 6 inches and 5 feet 4 inches long, which seems pretty short, even for a road of 3-foot gauge.

Los Angeles & Independence.

Efforts are being made to secure stock subscriptions for this proposed narrow-gauge road in San Bernardino, Cal., and other places on the line.

Delaware River & Bound Brook.

The survey and map of this projected road has been filed with the Secretary of State at Trenton, N. J. The line commences at the Delaware River near Yardleyville and runs northeast through Pennington, Hopewell, Stoutsberg, Blawenber and Harlingen and strikes the Central of New Jersey 1 1/2 miles west of Bound Brook station. It crosses the Mercer & Somerset near Hopewell, and for much of the distance is nearly parallel with that road and is nowhere far from it. The crossing of the Delaware is to be at Keeler's, near Yardleyville. Agreements have been made with nearly all the land-owners along the line for the right of way. The road is 27 miles long.

Levis & Kennebec.

The contractors, Laroche & Scott, are pushing forward the grading from Levis, Quebec, southward. Much of the lumber required for buildings, fences and bridges was cut and brought out of the woods on the line last winter. A Howe truss bridge over the Echemin River at St. Anselm is completed. The rails are on the way from England, and two engines from the Rogers Locomotive Works at Paterson are on the road.

Central, of Iowa.

In the foreclosure suit in the United States Circuit Court for Iowa, which was brought by the Boston bondholders, but opposed by the New York party, it was demurred to the complaint that the applicants did not constitute a majority of the bondholders. August 11, Judge Dillon decided to take the demurrer under advisement, the plaintiffs in the meantime not to be precluded from filing an amended bill. The application for a receiver is denied, but an order is granted forbidding the company to pay any debts or expenses, except actual operating expenses, without an order from the Court. The motion for a receiver may be renewed at the next term and further affidavits may be filed up to September 1.

All the bondholders appear to desire a foreclosure, but there is a contest between the New York and Boston parties for the control of the proceedings.

The Wisconsin Railroad Law.

At the close of the arguments in the injunction case in the Wisconsin Supreme Court, August 12, the Court adjourned for two weeks. No decision, consequently, will be given until the Court meets again, August 26.

Rome, Watertown & Ogdensburg.

It is stated that this Company has completed the negotiation of \$2,000,000 of its consolidated convertible bonds, one-half in London and one-half in the United States. The proceeds of these bonds will be used in making the payments required on account of the recent purchases of controlling interests in the Lake Ontario Shore and Syracuse Northern roads, and the extension westward of the former line. The negotiation was made through J. S. Kennedy & Co., of New York.

Lake Ontario Shore.

This road is to be sold at auction under a judgment of foreclosure granted in a suit brought by Willis Phelps and J. J. Kellogg, trustees. The sale will take place in Oswego, N. Y., September 22.

Chicago, Rock Island & Pacific.

In the case of the City of Joliet (Ill.) against this Company the Circuit Court decides that the Company must remove its track from the public square as required by the city, but allows one year's time, in which to make the change. The Company has taken an appeal.

California Pacific.

In the District Court of San Francisco, August 7, a suit was commenced by Michael Reese against the California Pacific Railroad Company, M. S. Latham, J. B. Frisbie, D. W. C. Haskin and others, to compel the defendants to account for moneys received on account of the California Pacific Extension Company. The complaint is very long and gives a history of the transactions connected with the building of the California Pacific and its consolidation with the Extension Company. It alleges that the latter company was a fraud from the beginning, and that there was never any intention of building the road. The plaintiff holds 200 shares which, he claims, he was induced to purchase by false representations, and he now demands an account from the company, or rather its successor.

New York & Oswego Midland.

A meeting of the first-mortgage bondholders is called for August 28, at the Cooper Institute in New York, to receive the report of the Committee.

It is stated that the committee does not consider the retention of the Rome and Utica branches under the present leases advantageous to the road, and that they have informed the receivers that they will take no action looking to the continuance of those leases.

Mr. Hewitt, Receiver of the road, has addressed a circular to the assessors of the towns on the line, laying before them a correspondence with Mr. Stevens, the General Manager, in which it is stated that the road does not yet earn its current expenses and therefore has no present value, and that it will not be possible for the receivers to pay taxes if they are imposed. In Mr. Hewitt's letter to Mr. Stevens, he intimates that the act authorizing taxation of the road, which was passed by the last Legislature, is of doubtful validity. Nevertheless he is not prepared to enter into vexatious and expensive litigation, and if the taxes are imposed, he believes the

LOCOMOTIVE RETURNS, FEBRUARY, 1874.

Master Mechanics of all American railroads are invited to send us their monthly reports for this table.

NAME OF ROAD.	Number of miles operated.	Number of Locomotives in service.	Mileage.	No. Miles run to		Cost per Mile in Cents for							Av'r cost of wood, per cord.
				Ton of Coal.	Cart of Wood.	Freight	Freight	Freight	Freight	Freight	Freight	Freight	
Atlantic & Pacific and leased lines.....	228	80	252,590	32.48	15.74	6.78	8.78	0.53	7.15	23.24	\$2.875	\$2.51	
Atlantic & Great Western (First & Second Div.).....	228	80	181,272	35.43	15.92	6.13	8.32	0.60	0.96	6.44	22.45	2.82	3.43
" " " (Third & Fourth Div.).....	203	51	103,910	35.43	15.15	5.29	8.32	0.56	1.04	6.13	21.34	2.82	3.43
" " " (Mahoning Division).....	113	60	115,780	35.43	18.89	3.24	8.32	0.48	0.58	6.03	18.65	2.82	3.43
" " " (Shenango & Allegheny).....	33	7	10,395	30.66	20.56	2.92	4.50	0.38	1.32	5.55	14.77	2.46	2.25
California Pacific.....	148	37	24,053	47.44	25.56	5.43	15.88	0.56	0.63	6.93	22.80	7.25	6.00
Central Pacific (Western Division).....	173.4	37	90,833	45.55	26.35	12.79	16.89	0.87	0.87	8.30	36.85	7.42	4.61
" " " (Sacramento Division).....	119.5	39	88,271	37.00	15.77	10.98	16.38	0.86	0.86	8.47	37.87	7.42	4.61
" " " (Truckee Division).....	204.5	26	60,260	34.16	50.00	6.15	21.12	0.70	0.70	8.08	35.05	7.42	4.61
" " " (Humboldt Division).....	236.6	21	59,171	37.00	15.77	4.89	19.52	0.70	0.70	7.29	32.40	7.42	4.61
" " " (Salt Lake Division).....	182.8	23	59,187	35.68	14.30	9.73	20.30	0.85	0.85	8.25	39.13	7.42	4.61
" " " (Oregon Division).....	151.48	6	17,376	40.13	20.04	5.66	11.49	0.66	0.66	7.79	25.60	7.42	4.61
" " " (Vernalis Division).....	188.3	8	17,190	58.07	17.03	9.36	13.69	0.74	0.74	8.35	32.14	7.42	4.61
Chicago, Burlington & Quincy.....	290	290	569,551	32.13	13.21	6.56	9.50	0.64	0.64	8.45	25.15	3.00	4.25
Chicago & North Western (Wis. & Mil. Div.).....	425	425	226,889	34.99	13.21	6.72	15.14	1.01	1.01	8.35	31.22	3.50	4.25
" " " (Madison Division).....	42	42	103,928	29.18	15.46	8.31	13.93	1.19	1.19	7.68	30.11	3.50	4.25
" " " (Galena Division).....	71	71	178,282	31.96	15.46	12.16	11.08	1.09	1.09	9.29	33.62	3.50	4.25
" " " (Iowa Division).....	73	73	168,654	27.62	15.46	8.72	12.75	0.96	0.96	8.26	30.69	3.50	4.25
" " " (Perinola Division).....	14	14	31,307	35.81	15.46	6.20	11.54	0.71	0.71	8.14	26.59	3.50	4.25
" " " (W. & St. Peter Lines).....	31	31	99,492	29.34	15.46	4.10	15.16	0.89	0.89	7.44	27.59	3.50	4.25
Chicago, Rock Island & Pacific (Illinois Div.).....	87	87	165,762	36.69	15.92	5.01	7.75	0.53	0.53	7.04	20.42	2.75	4.00
" " " (Iowa Division).....	111	111	245,623	32.20	13.55	5.01	8.82	0.58	0.58	6.87	21.28	2.75	4.00
Cleve., Col., Cin. & Ind. (Columbus Div.).....	138	54	127,356	43.61	43.39	3.09	7.29	0.53	0.53	7.21	18.12	2.96	3.57
" " " (Indianapolis Div.).....	207	65	169,111	43.29	50.12	4.95	7.49	0.62	0.62	7.60	20.66	3.03	3.50
" " " (Cincinnati Div.).....	130	27	63,526	39.08	51.39	2.74	7.95	0.57	0.57	8.14	19.49	2.90	3.50
Cleveland & Pittsburgh.....	83	83	147,838	62.70	16.99	4.60	4.90	0.70	0.70	7.05	17.25	2.30	1.90
Del., Lacka. & West. (Bloomsburg Div.).....	80	21	48,010	39.26	15.19	4.14	5.33	0.73	0.73	6.00	16.2	2.75	4.00
Denver Pacific.....	14	14	14,581	50.07	16.31	4.72	6.80	0.42	1.18	5.87	18.69	3.50	4.01
Illinois Central (Chicago Division).....	252.5	63	126,174	36.90	15.04	7.67	5.38	0.37	0.37	6.93	20.36	1.90	4.30
" " " (South Division).....	230.75	29	70,228	31.22	12.58	8.03	6.33	0.37	0.37	6.74	21.47	1.90	4.30
" " " (North Division).....	225	44	107,289	28.13	15.13	6.46	8.35	0.74	0.33	6.75	22.47	1.90	4.30
" " " (Iowa Division).....	401	40	90,430	32.48	16.14	5.09	7.43	0.40	0.40	6.79	21.71	2.30	5.94
Indianapolis, Bloomington & Western.....	40	65	146,670	32.48	9.13	4.80	8.80	0.83	0.83	6.00	23.23	1.94	2.90
Kansas Pacific.....	125	125	125,377	33.21	12.24	5.36	12.25	0.57	0.57	6.61	24.79	4.00	4.30
Lake Shore & Michigan South. (Buffalo Div.).....	91	91	196,849	46.60	37.00	5.98	7.56	0.57	0.57	5.94	19.48	3.50	5.94
" " " (Erie Div.).....	113	209	209,680	41.97	52.32	6.13	8.31	0.57	0.57	6.21	20.65	3.50	4.98
" " " (Toledo Div.).....	79	79	162,399	39.69	49.20	5.57	11.23	0.57	0.57	6.74	23.54	4.00	4.98
" " " (Mich. South Div.).....	208	208	415,894	38.40	51.20	5.52	9.41	0.57	0.57	7.14	22.07	4.50	5.00
Leavenworth, Lawrence & Galveston.....	203.7	16	23,350	60.80	30.40	4.48	7.14	0.43	0.43	6.44	18.49	4.00	5.00
Marquette, Houghton & Ontonagon.....	10	10	12,725	61.01	12.52	4.63	12.07	1.23	2.76	9.85	72.54	7.00	2.00
Pennsylvania (New York Division).....	119.9	116	268,604	33.97	36.76	2.10	16.30	1.20	1.20	19.60	0.19	7.00	1.00
" " " (Amboy Division).....	154.2	64	105,461	45.23	47.17	0.50	12.40	1.10	1.10	10.00	0.19	7.00	1.00
" " " (Belvidere Division).....	84.6	38	61,693	41.53	36.67	0.50	13.40	1.10	1.10	15.30	0.19	7.00	1.00
" " " (Philadelphia Division).....	204.3	157	378,258	30.02	14.58	2.40	7.70	0.50	0.50	11.00	0.08	3.25	0.19
" " " (Middle Division).....	131.6	131	306,813	27.88	18.05	5.00	8.30	0.70	0.70	14.00	0.08	3.25	0.19
" " " (Pittsburgh Division, East End).....	89	89	142,583	20.03	9.84	7.20	11.50	1.10	1.10	19.80	0.08	3.25	0.19
" " " (Pittsburgh Division, West End).....	126	126	235,175	31.06	13.16	4.80	7.50	0.90	0.90	13.20	0.08	3.25	0.19
" " " (Tyrone Division).....	100.3	29	37,818	25.21	19.45	5.80	9.20	0.80	0.80	18.80	0.08	3.25	0.19
" " " (West Pennsylvania Division).....	103.6	31	50,428	37.47	29.24	12.80	6.50	0.50	0.50	19.60	0.08	3.25	0.19
" " " (Lewistown Division).....	62.5	9	11,605	50.81	19.30	9.00	4.80	0.80	0.80	14.60	0.08	3.25	0.19
" " " (Bedford Division).....	55.6	6	11,143	53.46	20.75	9.30	4.50	0.70	0.70	14.50	0.08	3.25	0.19
Pitts., Fort Wayne & Chicago (Eastern Div.).....	468.9	179	495,972	39.19	11.49	3.73	6.65	0.73	1.05	6.36	18.52	per ton.	1.00
" " " (Western Div.).....	289	118	317,176	36.80	23.70	4.70	7.90	0.50	0.50	6.40	19.50	2.60	3.25
Pitts., Cin. & St. Louis (Little Miami Div.).....	41	41	90,195	41.90	9.85	6.00	7.80	1.10	2.10	7.50	24.50	2.75	3.43
South Carolina.....	38	71	71,289	40.18	27.78	6.55	6.68	0.67	0.67	13.90	0.28	2.60	3.43
Toledo, Wabash & Western.....	395,804	45.14	12.72	12.72	12.72	6.10	5.85	0.70	1.42	5.39	19.46	2.60	3.43

* Switching engines allowed 6 miles per hour.

only course for the receivers will be to report the facts to the court and to abandon all efforts to keep the road open. In this opinion Mr. Stevens concurs.

Miles Branch.

It is proposed to build a branch line about ten miles long from Miles, Mich., southeast to the Chicago & Lake Huron road near the State line.

The Hoosac Tunnel Line.

It is now certain that much additional arching will be required to make the tunnel entirely safe. The arching contract has been taken by the Shanley Brothers, who completed the excavation of the tunnel. It is understood that Messrs. Washburn and Chadbourne of the Commission will take upon themselves the special duty of watching the work on the tunnel.

East River Bridge.

The keystones of the arches in the Brooklyn tower were raised to their places August 8. They weigh 11 tons each. This tower is now 225 feet above high tide and will probably be finished by November. The New York tower is now 148 feet above high tide, and it is expected it will be carried above the spring of the arches before cold weather. The Brooklyn anchorage is now 40 feet up, but that on the New York side is not yet begun.

The Brooklyn City Council has voted to make an additional subscription of \$2,000,000.

Lumber Freights.

Heretofore there have been great differences in practice as to the standard employed in charging freights on lumber. A meeting was held lately at which representatives of the principal railroads in Michigan and Ohio, and some in Indiana, were present, at which it was voted to make weight the standard.

Meeting of Northwestern Railroad Commissioners.

At the convention held in Dubuque, Iowa, August 13, the Commissioners of Illinois, Wisconsin and Minnesota were present. Disappointment was expressed at the absence of the Iowa executive officers charged with enforcing its railroad laws. The convention appointed the following committees:

On Classification of Rates of Transportation—D. A. Brown, Illinois; J. J. Randall, Minnesota; J. W. Hoyt, Wisconsin.

On Railroad Reports—Geo. H. Paul, Wisconsin; A. J. Edgerston, Minnesota; James Steele, Illinois.

On Legislation—William R. Marshall, Minnesota; John M. Pearson, Illinois; James H. Osborn, Wisconsin.

Commissioner Edgerston of Minnesota submitted resolutions touching the objects and results of railroad legislation, which, after some discussion, were laid on the table.

After perfecting a few business arrangements, the session was adjourned to meet at Madison, Wis., on the last Tuesday in September.

Captain Tyler and the Erie Railway.

The following copy of a letter from Captain Tyler, relating to the Erie Railway, was posted in the London Stock Exchange on Monday afternoon, July 27: "London, July 23, 1874. Dear Sir—I have the pleasure of informing you that I returned from America last evening. My inspection and investigations in that country have extended over the Erie system, the Atlantic & Great Western system, and the Cleveland, Columbus, Cincinnati & Indianapolis system and their connections—altogether upwards of 2,000 miles, and my journeys by railway in America have extended over more than 5,000 miles. My report, therefore, upon the Erie system of railway and its connections will be necessarily voluminous, and I do not propose to issue it until the return to England of the accountants, who, I believe, will terminate their labors about the end of the present month. Meanwhile, you may rely on my carrying out

your wishes, which so entirely coincide with my own feelings in not affording any information, either to yourselves or to others, and when the time arrives for the issue of my report I intend to take every precaution to prevent any person from obtaining information prior to its publication."

Railroad Taxation in Missouri.

In the tax injunction suits in the United States Circuit Court, Judge Dillon has granted, in all the cases, temporary injunctions against the collection of taxes, which are to hold until the September term of the court in St. Louis, when a full hearing can be had.

Railroad Taxation in Indiana.

The Indiana State Board of Equalization has completed its assessment of railroad property in that State. The assessed value of all the lines is \$39,749,042. There are 60 different roads wholly or partly within the State, and the mileage returned is 3,737.12 miles main line and 457.51 miles second track and sidings, 4,194.63 miles in all.

Lake Shore and Michigan Southern.

This company is constructing at Elkhart a round-house with 20 stalls, having there already one with 23 stalls. The foundation of a new engine-house is laid at the same place, where the company employs between 700 and 800 men.

United States Contracts.

S. T. Abert will receive proposals for dredging in Washington and Georgetown harbors, D. C., until noon of August 23, at the United States Engineer Office, No. 2,106 H street, Washington.

Contracts.

The Commissioners of Long Island City (which adjoins Brooklyn, L. I., on the north) ask proposals for furnishing all the materials and for grading in the improvement district in that city down to noon of August 26.

The Sewer Commissioners of Hoboken, N. J., will receive proposals until 11 a. m. of September 1 for furnishing the pumps, and the steam boilers and engines for driving them, to be used in the drainage of the Hoboken meadows. Information can be had of Charles Chamberlain, Secretary, in Hoboken, or of L. W. Post, Engineer, opposite the Court House, Jersey City Heights.

Des Moines & Chicago Rates.

The Chicago, Rock Island & Pacific and the line formed by the Chicago, Burlington & Quincy and the Keokuk & Des Moines between Chicago & Des Moines have agreed upon a rate upon all traffic originating east of Illinois for transportation to Des Moines. From Chicago and the adjoining junctions with eastern roads at Englewood, Washington Heights and Joliet the rate will be for the four classes 75, 65, 55 and 40 cents respectively, and 37 for special; from the Iowa line at Keokuk or Burlington they will be 50, 42, 34, 23 and 23. Freight from sea-board cities will be subject to the trunk lines classification, those from Pittsburgh, Wheeling, Buffalo and Cleveland to the Pittsburgh classification.

Bolivar Railway.

This English company was recently in the London market for a loan of £200,000 to aid in completing its railroad for the copper mines of Aros, in Venezuela, to the port of Tucacas, 62 miles. A contract has been let for constructing the road for £221,000, and it is reported that the work is progressing satisfactorily, that the line is cleared for nearly its whole length, that the first section is open and that four-fifths of the material has been sent out and paid for. The contractors are James Perry & Co. and Cutbush, Son & De Lango, who expect to have the road open throughout by next May.

Contributions.

A Chapter of Complaints on Railroad Management.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Any one who has, for the last thirty years, taken a lively interest in the progress of American railroads, and paid close attention to the improvements in all that pertains to construction and maintenance of permanent way, will not fail to notice that within the last five years the condition of many of our leading roads has improved wonderfully. That some changes for the better would take place as we advanced in age and experience was reasonably expected; and, in some instances, these expectations have been realized, and in a few improvements are visible of such a character as to satisfy the most industrious seeker after perfection. The most noticeable feature in this connection is the fact that some managers have changed their views in regard to what constitutes economy.

The matter of economy under consideration is of that kind that works on the principle that "an ounce of prevention is better than a pound of cure." This is a homely old adage, but it is a good one, and perhaps there is nothing to which its teachings so well apply as in railroad management. The office of the fault-finder is not a pleasant one, nor is it one that is likely to increase the list of one's friends; but for the purpose of giving the railroad public the benefit of an extended tour of observation, I know of no better plan than to find fault with everything I have seen that is wrong. What I have seen that is right (and there is much of it) will be the subject for a future consideration.

There is a road up in one of the Middle States that is now laying new rails for the third time; that is, they have worn out two sets of rails. The road-bed has always been well ballasted, so that now it should be in a good condition for laying a perfect track and one that would give the rails a long life under any amount of traffic. It may be proper to state here that the company was obliged to use its bottom dollar to secure these new rails. Therefore it would seem that all reasonable measures should be adopted to preserve these rails which have cost so much money from going to rapid destruction. But here this is not the case, and it seems the more singular when we remember that the General Superintendent has gained his present position through a long experience in track superintendence. This is the way the new rails are handled from the time they are received. In unloading the rails are thrown from the cars in a careless manner; falling across each other, giving them frightful kinks, which will not only shorten the life of the rail itself but give it those little things that seriously interfere with the smooth running of trains. Of course a kink will cause a variation from a correct gauge, which may be too wide or too narrow. In the former case there is room for a powerful "side thrust" which tells rapidly on the rail and also injures locomotives and cars to no small degree. One of these would ruin any company, but when a great number of them get into the track the effect is serious in the course of time. In laying the rails the spaces for expansion are not kept uniform, some joints open $\frac{1}{4}$ or $\frac{1}{2}$ of an inch and others perfectly are tight. In this way the destruction by brooming at the joints commences at once. The joints are not secured properly either laterally or perpendicularly, so that cutting and brooming begin with the first train over it. The ties are not properly spaced or placed in position to give the joint that support which is necessary to prevent one rail being higher than the other, which is not right. In laying around curves instead of cutting the inner rail (or, what is better, having short rails provided for the purpose) they leave open joints on the outside of the curve. Many joints are two inches open and some of them four inches* and some time or other they contemplate drilling the rails so that the fish bars can be bolted on. On the old rails thick cast-iron chairs were used, which leave the old joint ties nearly two inches below the new rail, and as there were from one to three ties each side of the joint-tie considerably low by reason of the track being badly out of surface, the new rail is left without any support for several feet. The effect of this is obvious. Some spikes are driven into these ties as far as the rail will allow, and there they stick in all positions, some slanting under the rail, some leaning forward, some backward, and none touching the rail or doing any good. The gauge is only used here and there, and many of the ties are not spiked at all. There are hundreds of ties so decayed as to be worthless; the track is not lined up, and these new and costly rails are left open to certain and speedy destruction. The road-bed is literally strewn with spikes that are being wasted in the ground. All the old chairs lie about in the ditches and are being covered with mud and gravel; hundreds of old rails and pieces of rails are lying about in the way ready to be lost, and there is an air of slovenliness or heedlessness, willful neglect, or something of that sort, in all that one can see where this is going on. This is not where the new iron was laid yesterday and may be put to rights to-morrow, but it has remained in this condition for weeks, and some of it for months, and with a fair prospect of its remaining so for months longer. In short, the prevailing idea seems to be to get the new rails down in any shape, then climb on them with the rolling stock, and there is nothing more to do. The thought that they have 50 miles of new iron relieves them of a load of care, and they swell with pride when calling your attention to the smoothness of their track from the rear platform. The General Superintendent of this road was Road-Master for years, the roadmasters on the line are all old sectionmen and track-layers, and this is said to be a well-managed road. Paragraphs in the local papers speak of the excellent management

*There is no engineering department on this road.

of the road and its superb condition. Perhaps the pass system has not been abolished here.

There is one division of this road on which new rails were laid about a year since. There is some good track on this division, and some fast time is made here; perhaps as good as any in America. Still there is room for great improvement in the permanent way. The roadmaster in charge of this division is considered one of the best on the line. He certainly has had a long experience, and will compare favorably with what are styled "tip-top men." But he has the falling common among roadmasters of paying his whole attention to surface. It is, of course, desirable to get the surface of track as nearly perfect as possible, but it is by no means the most important requisite for a good track. The line of the track on this road is sadly neglected, and this is the case on too many of our so-called first-class roads. An observing passenger on most easy roads will not fail to notice "heavy lurches" from side to side, and these are caused by "swings" in the track. These "swings" are the result of neglecting to line up when surfacing. For instance, when raising the track, it is pulled out of line first to one side then the other. This at first forms "little elbows," which give sudden "yanks" or "jerks" to cars, and the force with which the flanges are thrown against the rail has a tendency to move the track out of line in the direction of the shock. This being frequently repeated by passing trains, the track finally becomes straightened out from one elbow to another and a swing is created. Another cause of swings is the neglect to keep track level in its cross-section, especially when the ballast is of a light nature. It must be remembered that locomotives and long freight trains are heavy, and a slight "sag" over to one side acts with great force on the rail—sufficient to move it out of line. In putting up track the level should always be used.

Another thing readily noticed on the road in question is the lack of uniformity in the elevation of curves. This is left to the section-men, and they are put up by guess. There is not a section-man on the road who knows the degree of curvature of any curve, and he elevates each according to his taste and judgment, and the consequence is too much elevation or not enough. There is no rule for doing anything, but all is left to the "notion" of those in charge of the work. Frogs and crossings are laid without any rule, and the work is of all sorts, good, bad and indifferent. The gauge of the track is bad, and it would pay well to attend to it at once. The ditches are full of trash of every description, the fences are neglected, and the whole and only object seems to be to put the track in surface, as though there were no other requirements for a perfect track. This is on an old road, and one managed by old hands at the business, but it does not look right somehow, and it will do you no harm to think it over.

WM. S. HUNTINGTON.

Some Notes by the Way.

REFORM.

Another attempt to reform railroad management is being made, the lead being taken by the Pennsylvania, the New York Central and the Erie. It is proposed to create two boards of commissioners, one to represent the seaboard lines and the other to represent the Western companies. These boards in joint session are to make rates and to adjudicate in disputes. Competition is to cease, and the expense of "getting business" is to be reduced to a minimum. The lion is to lie down with the lamb, and Shylock is to forego his bond. The objects in view are good, and could they be attained both the railroad companies and the public would be gainers. "Competition is a thing of so hideous a mien that to be hated needs only to be seen"—in its true colors. While it does not increase the quantity of traffic, it vastly increases the cost of obtaining and transporting it. Railroad companies do not let us know the relation that cost of obtaining business bears to actual cost of transportation. Indeed, it may well be suspected that many of them, not daring or caring to face the question, deceive themselves. Under the head of "obtaining business" come advertising, contracting agents, extra offices, commissions, rebates, free passes, surplus accommodation, speed and luxurious appointments—items which foot up formidably at the end of the year. These bills have to be paid by the public, therefore it is interested in reducing them. Let speed and luxury be paid for by those who choose them.

Reform is very desirable, but are the reformers in earnest? Are they going about the work in a proper way? Let us suppose the Board of Commissioners representing the Western interests only elected, what then? They are to make rates. They are to fix the speed of trains. They are to decide how many and what kind of offices each company is to have at common points. They are to put a stop to commissions, rebates and all the tricks of trade. But how are they to do this? What power have they to enforce their decrees? None whatever. It follows that if they have no power their decrees will not be respected. Is it possible to fix any rate which shall be satisfactory to all the railroad companies in the country? Certainly not. The originators of the movement seem to have overlooked the principles which lie at the bottom of all successful attempts at reform. Where there are many diverse interests there can be only two methods of obtaining concurrent action—force and reward. A powerful combination must force the weaker ones to agree to terms, or else there must be such a division of profits that there will remain no temptation to cut loose. Combination and pooling are the only two ways of abolishing competition. All attempts to secure peace by other means are not worth the time spent in traveling from Albany to Saratoga.

Let us suppose a case for the commissioners: They have to insist on equal rates between common points. Equal rates infer equal time; that is to say, that taking St. Louis and New York as the points, all the different routes shall charge the same fare and make equal time. But suppose one line steps

in to say: "I am a short line; I can get my trains through in four to five hours less time than any other route can; I cannot agree to forego this advantage." The other lines say: "Will you allow us to reduce our fares in proportion to your time?" Of course the short line will not agree. It can make as good time mile for mile as any other route, its appointments are as good as those of its competitors, it is inferior in no particular, it can run its trains as economically mile for mile as any of its rivals can—may more so by reason of its greater patronage. Having then these advantages both in speed and cost of transportation, why should it yield any of them without consideration and who shall be the judge of that consideration? The claim that such advantages shall be foregone is preposterous, yet this is one of the first nuts that the commissioners have to crack before they can secure the kernel. Unhappy commissioners!

WHY DON'T RAILROAD MEN WRITE?

"Why don't you write on the subject and give us the benefit of your ideas and experience?" said I a short time ago to a gentleman who was explaining some advantages of the system of train-dispatching in operation on his road, which he claimed to be the best in the country, and which, as he said, had been perfected by himself. His answer was: "Well, one doesn't gain anything by writing, but one might lose a great deal. It is best to keep quiet." I used at one time to wonder why railroad men did not appear more often in your columns. Latterly I have asked myself why should they? Some men write for fame, others urged by professional ambition—neither of them unworthy motives. Is there none in the railroad army who desires to earn either fame or advancement, or are they all afraid that they had better keep quiet? Railroad men are naturally modest; perhaps, having read the story of the fly on the wheel, they have no inclination to make it appear that the world cannot get on without them. Promotions in the past have not been made in a manner that would encourage men to deserve advancement. Nepotism, favoritism, good fortune, possession of the secrets of a rival, unscrupulousness, all have had more to do with promotions than merit. Insecure tenure of office has had a blighting effect on all ranks of railroad employees. No one felt sure of holding his place for a month to come, and therefore felt little inclination to lay out plans for the future. Although no revolution is impending, it is certain that a new era has begun to dawn in railroad management and that in future men who show special fitness for certain departments will receive encouragement. Although experience will be estimated highly it will not be criminal not to be a "practical man." Men of thought and theoretical training will find many positions open to them, but they must show their fitness; if they have ideas they must express them; they must not expect that managers will hunt about to find these difficult young men of brilliant ideas. It must not be forgotten that if education and ability have not received the encouragement they should have, the managers are not altogether to blame. The candidates must seek to make their talents visible; they must show forth their works, not Gaynor-like in a miserable desire for notoriety, but by solid proof of ability and power to reason.

It would be well for young aspirants to remember also that while the demand for railroad clerks and officers will increase very slowly in the future, the number of candidates will be greater each year, and the intellectual capacity of the candidates will reach a higher standard year after year. Then when the standard of general ability is high and the number of candidates coming up to that standard exceeds the demand, special training and special knowledge will become valuable, and its possessors will be the fortunate ones. The tendency of the rising generation to be content with nothing but "gentle" employment is certain to bring want and misery to many within the next twenty years. Even now middle-aged and elderly men with families find themselves crowded out by boys who can afford to work at an apprentice-wage.

MISSING LETTERS.

Every one who has had much correspondence with railroad offices must have been struck by the large proportion of letters "not received" by the parties for whom they were intended and perhaps has suspected, as we have, that the Post-Office Department is not so much to blame as is the carelessness of clerks and the want of system in the offices. It is so easy to say, "Your letter referred to has not reached this office," or "Your letter was duly replied to," that the temptation to get rid of responsibility in that manner must be great. In some offices there is an attempt to register and index all correspondence, but as the work is generally intrusted to boys without supervision it is not properly done, and therefore is unreliable, and an unreliable register is worse than none. Railroad offices have acquired a reputation for incivility which is not altogether undeserved, although perhaps in many cases one of omission, not of commission. All letters, after being opened by the proper person, should be registered, and in due time their disposal also registered. The head of the office would then be able to ascertain if a specified letter was received, and what had been done with it. Also by a periodical inspection of the record it would be seen whether any communication remained unacknowledged. Without such arrangements no large office can keep up its work satisfactorily and escape the imputation of incivility, which in all business matters had best be avoided.

HINDOO.

Railroad Conventions and Reform.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The able letter by "Hindoo" in the number for August 8 is a correct delineation of the solemn farces called superintendents' conventions; and it is evident by their sheepish behavior that the gentlemen who take part in them are fully aware of the ridiculous figure which they make; yet, animated by the hope that something may be said which shall be

instructive or useful, and more by the certainty that they will meet with an able body of men who are similarly occupied, many are induced to repeat their attendance on them.

The Railway Association of America and the Western and Southern Railway Association both made the same error, that they appointed committees upon multitudes of topics, without any consultation with the members so appointed, some of whom did not even know that they were members of the Association, and others who did know that they were, wholly unfitted by taste and experience for any service on such committees.

All know how very meagre, with a few exceptions, the reports to those associations were. Work of the kind expected from those committees must be done as a matter of duty which cannot be slighted, or from an interest in the subject to be studied; no other motives will prevail long with a body of men so busy as superintendents are.

It is also true that, taken as a class, they are practical men, not students nor writers; and an Association composed exclusively of them will never do anything more than construct a time table.

As the Master Mechanics' Association wisely provided for the admission of a few scientific persons, whose vocation it is to study, to write, to talk, so it will be first necessary for any successful association for the improvement of railroading to include in its membership persons similarly gifted. It may be shown, I think, that the members of the American Society of Civil Engineers have given us more information on the subject of operating railways than we have received from any other source. They were self-appointed to their work, and did it for the satisfaction derived from knowledge.

If the engineering department of railways can be enlisted in the Railway Association, that may infuse into it a spirit of inquiry and of accurate observation which does not now exist.

So far, I have referred only to those conventions of superintendents which have been held for the ostensible purpose of increasing knowledge and perfecting our system of operating railways; it remains to consider why those conventions of superintendents which have been called to inaugurate certain reforms have been unsuccessful.

The sole reason is want of power. There has often been conviction of the need or of the desirableness of the measure proposed, and it could be carried by the almost unanimous vote of the gentlemen present; but of what avail is the vote?

There are four (4) persons only in the United States, outside of New England, who have a vote in that august assembly, which decides all matters of competition and of general reform; and one meeting of that body at Saratoga, if it is good-natured, can accomplish more in the way of reform than all the conventions of superintendents that could be held. There is no need of a permanent recording secretary for the Saratoga meetings; the recording angel and the gentlemen who form the quadrilateral all take notes, and know what is agreed upon.

There is room, now, only for missionary effort; let the four belligerent powers be once convinced that harmony is more profitable than war, and we shall have peace. Let superintendents, and others interested in railway reforms, take palms in their hands and olive branches, and strive to pacify those to whom the eight august ears are open, so that they may hear of temperate measures.

This is all there is for the superintendents to do towards reform; and, at conventions, looking into each other's faces, they see that every other knows how it is himself; and so they are abashed and ashamed.

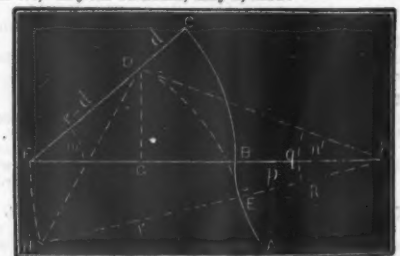
ARCHIMEDES S. WATT, Gen. Supt.

UPPERMERE, Aug. 10, 1874.

Finding Point of Reversion or Changing a Reversed Curve.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The following is a solution of the problem submitted by "C. E. W." in your columns, May 2, 1874:



Given R , r and m , to find E , where the curve must be reversed to pass through D , C and D being known:

Through D pass the radius FD . With K as a center, and a radius $KF=R+r$, describe FG . With D as a center and radius $DH=r$, describe an arc intersecting FG in H . Draw HK , cutting the arc AB in E . With the center H , and radius $HE=HD=r$ draw ED , the second branch of the curve. E is the point of reversion required.

To determine the angle $BKE=p$ through which the point E must be moved back from B :

Draw $DK=U$; and DG perpendicular to FK .

Let $HK=FK=R+r$, $FD=r$, $AD=B$, $DKF=\alpha$ and $DKH=\theta$

$\tan \alpha = \frac{DG}{DK} = \frac{FD \sin \theta}{DK} = \frac{r \sin \theta}{R+r}$ (1)

$\tan \theta = \frac{DG}{DK} = \frac{FD \sin \alpha}{DK} = \frac{r \sin \alpha}{R+r}$ (2)

$DH = r$, $DK = R+r$, $DKH = \theta$, $DKF = \alpha$, $DKH = \theta$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

$DKH = \theta$, $DKF = \alpha$, $DKH = \theta$, $DKF = \alpha$

By substituting the values of α and θ derived from (1) and (2) in (3), the value of p is found.

THOS. J. LONG, C. E.

NEW YORK CITY, July 25, 1874.

* Davies' Legendre—Mensuration, Art. (97).